UPSSSC 2026

UTTAR PRADESH SUBORDINATE SERVICES SELECTION COMMISSION

SUGARCANE SUPERVISOR

Mains Exam

Part - I

Agriculture Science

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UPSSSC Sugarcane Supervisor Mains Exam
Part - I : Agriculture Science
Edition: August 2026
Published by :Nodia
An Imprint of NODIA EDITIONS LLP

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MRP ₹600.00

NODIA EDITIONS LLP
125, Sector 6, Vidyadhar Nagar, Jaipur 302039
Phone :+91 9001005245
email : mail@nodia.in

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CHAPTER 01

Crop Classification and Major Crop Groups

1. Based on their agricultural life-cycle and economic use, how is the commercial sugarcane crop primarily classified?
(A) As an annual crop grown for its fruit
(B) As a biennial or perennial crop grown as an annual cash crop for its stem
(C) As a seasonal Zaid crop grown for fodder
(D) As a short-duration Kharif pulse crop

2. The traditional Kharif season in Uttar Pradesh generally aligns with which of the following sowing and harvesting periods?
(A) Sown in October-November and harvested in March-April
(B) Sown in March-April and harvested in June
(C) Sown in January and harvested in May
(D) Sown in June-July and harvested in September-October

3. 'Co 0238' is a highly popular and widely cultivated sugarcane variety in Uttar Pradesh. Which of the following characteristics best describes its agricultural classification?
(A) It is an early to mid-late maturing, high-yielding and high-sugar recovery variety.
(B) It is a late-maturing, low-sugar variety meant primarily for fodder.
(C) It is a chewing-type cane variety with extremely low commercial sugar content.
(D) It is a wild relative of sugarcane used strictly for breeding purposes.

4. Match the major crops of Uttar Pradesh (List I) with their correct botanical names (List II).
List I: (Crop)
P. Wheat
Q. Paddy
R. Pigeon pea (Arhar)
S. Sugarcane
List II: (Botanical Name)
1. Saccharum officinarum
2. Triticum aestivum
3. Oryza sativa
4. Cajanus cajan
(A) P-2, Q-3, R-4, S-1
(B) P-3, Q-2, R-1, S-4
(C) P-2, Q-4, R-3, S-1
(D) P-1, Q-3, R-4, S-2

5. What is the recommended seed rate for the late-sown wheat crop in Uttar Pradesh to ensure optimal plant population?
(A) 75 kg per hectare
(B) 100 kg per hectare
(C) 125 kg per hectare
(D) 150 kg per hectare

6. The 'Dapog' method of raising seedlings is a highly specialized nursery technique primarily associated with which of the following food-grain crops?
(A) Wheat
(B) Maize
(C) Sorghum
(D) Paddy

7. Given below are two statements, one labeled as Assertion (A) and the other labeled as Reason (R):
Assertion (A): Autumn-planted sugarcane generally records higher cane yield and sugar recovery compared to spring-planted sugarcane in Uttar Pradesh.
Reason (R): Autumn planting provides a longer grand growth phase and better utilization of tillering time before the onset of monsoon.
In the light of the above statements, choose the correct answer from the options given below:
(A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
(B) Both Assertion (A) and Reason (R) are true but R is not the correct explanation of A.
(C) Assertion (A) is true but Reason (R) is false.
(D) Assertion (A) is false but Reason (R) is true.

8. In maize cultivation, which growth stage is considered the most critical for irrigation to prevent significant yield loss?

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(A) Early vegetative knee-high stage
(B) Late reproductive grain dough stage
(C) Critical tasseling and silking stage
(D) Initial early crop seedling stage

9. 'Nipping' is an essential agronomic practice in the cultivation of gram (chickpea). What is the primary objective of this practice?
(A) To effectively prevent severe pod borer infestations during early crop growth
(B) To facilitate uniform early flowering and synchronized maturity of pods
(C) To reduce overall plant height strictly to prevent severe field lodging
(D) To remove the terminal apical bud to encourage lateral branching

10. Which of the following is strictly categorized as a Rabi pulse crop and does not fit into the Kharif season profile?
(A) Lentil (Masoor)
(B) Green gram (Moong)
(C) Black gram (Urad)
(D) Pigeon pea (Arhar)

11. What is the standard recommended seed rate for cultivating a pure crop of pigeon pea (Arhar) in Uttar Pradesh?
(A) 4-6 kg per hectare
(B) 12-15 kg per hectare
(C) 25-30 kg per hectare
(D) 40-45 kg per hectare

12. Consider the following statements regarding the contribution of pulse crops to soil fertility:
I. Pulse crops fix atmospheric nitrogen through a symbiotic relationship with Rhizobium bacteria.
II. Rajmash (French bean) is an exception among common pulses as it lacks effective root nodules and does not fix atmospheric nitrogen.
III. The process of nitrogen fixation strictly occurs in the leaves of the pulse crops during photosynthesis.
Which of the above statement(s) is/are correct?
(A) I and II only
(B) II and III only
(C) I and III only
(D) I, II and III

13. What is the average oil content typically found in the seeds of improved mustard varieties grown in Uttar Pradesh?
(A) 15 - 20%
(B) 25 - 30%
(C) 38 - 43%
(D) 55 - 60%

14. Phyllody is a devastating disease of sesame (til) in which floral parts are transformed into green leafy structures. This disease is transmitted by which of the following vectors?
(A) Whitefly vector
(B) Aphid vector
(C) Leafhopper
(D) Thrips vector

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15. The application of Gypsum (calcium sulphate) is highly recommended in groundnut cultivation specifically during the pegging stage. What is the primary purpose of this?
(A) To effectively control soil-borne white grub pest populations
(B) To enhance rapid early vegetative growth of the tap root system
(C) To decrease seed oil content while significantly increasing protein
(D) To promote proper pod and kernel development

16. In terms of photoperiodism, how is the sunflower crop classified, which allows it to be cultivated across Kharif, Rabi, and Zaid seasons?
(A) Short-day plant
(B) Long-day plant
(C) Day-neutral plant
(D) Intermediate-day plant

17. The feeding of early-stage sorghum (jowar) fodder to cattle can be fatal due to the synthesis of a toxic compound. What is the name of this toxic compound?
(A) Gossypol toxic pigment
(B) Hydrocyanic acid
(C) Saponin glycoside compound
(D) Erucic acid fatty compound

18. Which of the following provides the correct decreasing order of the top four states in terms of total sugarcane production in India?
(A) Uttar Pradesh > Maharashtra > Karnataka > Tamil Nadu
(B) Maharashtra > Uttar Pradesh > Tamil Nadu > Karnataka
(C) Karnataka > Uttar Pradesh > Maharashtra > Tamil Nadu
(D) Uttar Pradesh > Karnataka > Maharashtra

> Tamil Nadu

19. The Government of India's 'Shree Anna' campaign is intrinsically linked to the promotion and nutritional awareness of which group of crops?
(A) Millets and coarse cereals
(B) Major oilseed crops like mustard, groundnut, and sesame
(C) Traditional natural fibre crops like jute, cotton, and mesta
(D) Commercial cash crops like sugarcane, tobacco, and tea

20. Ginning is a primary processing operation for cotton. What is the standard ginning percentage generally observed in cultivated cotton varieties?
(A) 10 - 15%
(B) 30 - 35%
(C) 50 - 55%
(D) 70 - 75%

21. Retting is a crucial microbiological process in the extraction of fibre from jute. What is the optimum water temperature required for proper jute retting?
(A) 15°C - 20°C
(B) 25°C - 27°C
(C) 32°C - 34°C
(D) 40°C - 45°C

22. Match the commercial and spice crops (List I) with their respective botanical families (List II).
List I: (Crop)
P. Sugarcane
Q. Mustard
R. Coriander
S. Potato
List II: (Botanical Family)
1. Solanaceae
2. Poaceae (Gramineae)
3. Apiaceae (Umbelliferae)
4. Brassicaceae (Cruciferae)
(A) P-2, Q-4, R-3, S-1
(B) P-4, Q-2, R-1, S-3
(C) P-2, Q-3, R-4, S-1
(D) P-1, Q-4, R-3, S-2

23. Topping and desuckering are vital cultural operations carried out in tobacco cultivation. What is the main objective of these operations?
(A) To stimulate uniform early flowering and rapid reproductive seed production
(B) To divert energy toward leaf growth
(C) To increase overall height of the main stem for structural fibre extraction
(D) To reduce total nicotine accumulation in root tissues completely to zero

24. Consider the following statements regarding the maturity indices of the sugarcane crop:
I. A Brix reading of 18-20% in the cane juice indicates maturity.
II. The cane is considered mature when the glucose content in the juice drops below 0.5%.
III. When the crop is mature, the Brix readings of the top and bottom internodes become nearly equal.
IV. The moisture content of the sugarcane stem must fall below 20% to be considered mature for crushing.
Which of the above statement(s) is/are correct?
(A) I, II and IV only
(B) I, II and III only
(C) II, III and IV only
(D) I, III and IV only

25. The yellow colour and medicinal properties of turmeric (Haldi) are primarily due to the presence of which active biochemical compound?
(A) Allicin
(B) Capsaicin
(C) Piperine
(D) Curcumin

26. In the cultivation of coriander (Dhania) for seed purposes, the seeds are generally subjected to which specific physical treatment before sowing?
(A) Splitting seeds into two mericarps to enhance germination
(B) Boiling seeds in hot water for ten minutes to soften the outer seed coat completely
(C) Roasting seeds thoroughly at low temperatures to prevent storage fungal infection
(D) Soaking seeds in highly concentrated sulphuric acid for twenty-four hours

27. Japanese Mint (Mentha arvensis) is cultivated extensively as a commercial crop in the Barabanki, Budaun, and Moradabad districts of Uttar Pradesh. Which part of the mentha plant is economically harvested for oil extraction?
(A) Deeply penetrating primary tap roots
(B) Leaves and tender stems
(C) Fully matured commercial crop seeds
(D) Perennial underground woody rhizomes

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28. Which of the following constitutes the standard vegetative planting material used for the commercial propagation of garlic?
(A) True seeds
(B) Cloves
(C) Stem cuttings
(D) Tubers

29. Given below are two statements, one labeled as Assertion (A) and the other labeled as Reason (R):
Assertion (A): Cultivation of long-duration pigeon pea (Arhar) in western Uttar Pradesh frequently faces a high risk of crop failure during December and January.
Reason (R): Pigeon pea is highly susceptible to frost, and freezing temperatures cause severe cellular damage to the plant's reproductive parts.
In the light of the above statements, choose the correct answer from the options given below:
(A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
(B) Both Assertion (A) and Reason (R) are true but R is not the correct explanation of A.
(C) Assertion (A) is true but Reason (R) is false.
(D) Assertion (A) is false but Reason (R) is true.

30. Berseem is an important Rabi fodder crop that provides highly nutritious green fodder. Which specific species of Rhizobium is required for seed inoculation in berseem to ensure proper nitrogen fixation?
(A) Rhizobium leguminosarum
(B) Rhizobium japonicum
(C) Rhizobium trifolii
(D) Rhizobium meliloti

31. Napier grass is a high-yielding perennial fodder crop heavily utilized in the dairy sector. Because it does not produce viable seeds, how is it commercially propagated?
(A) Micropropagation through specialized in vitro tissue culture exclusively
(B) By direct sowing of true grass seeds imported annually from East Africa
(C) Propagation through dormant underground bulbs and swelling corms
(D) Through root slips or stem cuttings

32. Which of the following is a recognized multi-cut variety of oats (Jai) suitable for providing continuous green fodder over an extended period?
(A) Pusa Basmati-1
(B) Kufri Sindhuri
(C) UPO-212
(D) Co 0238

33. The 'Dashehari' variety of mango is famous worldwide and holds geographical significance. Which specific belt in Uttar Pradesh is historically recognized as its primary region of origin and commercial production?
(A) Saharanpur
(B) Malihabad (Lucknow)
(C) Varanasi
(D) Allahabad (Prayagraj)

34. The Central Institute for Subtropical Horticulture (CISH), Lucknow, has popularized the 'Meadow Orcharding' technique for guava. What is the standard plant spacing followed in this ultra-high-density planting system?
(A) 8.0 m x 8.0 m
(B) 6.0 m x 6.0 m
(C) 2.0 m x 1.0 m
(D) 1.0 m x 0.5 m

35. Consider the following statements regarding the 'Red Rot' disease, often termed the cancer of sugarcane:
I. It is caused by the fungus Colletotrichum falcatum.
II. A characteristic symptom is a sour, alcoholic smell emanating from the split cane.
III. The primary method of field transmission is through the use of infected sett planting material.
Which of the above statement(s) is/are correct?
(A) I and II only
(B) II and III only
(C) I and III only
(D) I, II and III

36. 'Sigatoka' is one of the most destructive diseases affecting the commercial cultivation of banana. What type of pathogen is responsible for causing this disease?
(A) A soil-borne nematode
(B) A sap-sucking insect
(C) A leaf-spotting fungus
(D) A systemic plant virus

37. Which causal organism is responsible for 'Citrus Canker', a disease that drastically reduces the market value of citrus fruits by forming corky lesions on leaves and fruits?
(A) Xanthomonas citri
(B) Phytophthora palmivora fungus

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(C) Alternaria alternata pathogen
(D) Citrus tristeza closterovirus

38. In the floriculture sector of North India, including Uttar Pradesh, when is the standard and most optimal time for pruning commercial rose bushes to ensure vigorous winter blooming?
(A) May - June
(B) January - February
(C) March - April
(D) October - November

39. What is the standard seed rate per hectare required for raising seedlings of African Marigold for commercial flower production?
(A) 200 - 300 grams
(B) 1.0 - 1.5 kg
(C) 4.0 - 5.0 kg
(D) 8.0 - 10.0 kg

40. Which of the following sequences represents the correct decreasing order of major food-grain crops in Uttar Pradesh based on their approximate annual production volume?
(A) Wheat > Paddy > Maize > Pearl Millet (Bajra)
(B) Paddy > Wheat > Pearl Millet (Bajra) > Maize
(C) Wheat > Maize > Paddy > Pearl Millet (Bajra)
(D) Paddy > Maize > Wheat > Pearl Millet (Bajra)

41. In potato cultivation, the True Potato Seed (TPS) technique significantly reduces the bulk of planting material required. What is the recommended TPS seed rate for planting one hectare of land?
(A) 100 - 150 grams
(B) 2.0 - 3.0 kg
(C) 15 - 20 kg
(D) 25 - 30 quintals

42. The Tomato Leaf Curl Virus (ToLCV) causes severe stunting and leaf curling in tomato crops, severely impacting yield. Which insect acts as the primary vector for transmitting this virus?
(A) Whitefly (Bemisia tabaci)
(B) Fruit borer (Helicoverpa armigera)
(C) Thrips (Thrips tabaci)
(D) Aphid (Aphis gossypii)

43. Match the agriculture and sugarcane research institutes (List I) with their correct headquarters/ locations (List II).

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List I: (Institute)
P. Indian Institute of Sugarcane Research (IISR)
Q. U.P. Council of Sugarcane Research (UPCSR)
R. Sugarcane Breeding Institute (SBI)
S. Vasantdada Sugar Institute (VSI)
List II: (Location)
1. Shahjahanpur
2. Lucknow
3. Pune
4. Coimbatore
(A) P-2, Q-1, R-4, S-3
(B) P-1, Q-2, R-3, S-4
(C) P-4, Q-3, R-2, S-1
(D) P-2, Q-4, R-1, S-3

44. The phenomenon of 'bolting' in onion refers to the premature emergence of seed stalks before the bulbs have fully developed. What is the primary environmental factor that triggers bolting in onion?
(A) Extremely high soil moisture coupled with prolonged waterlogging conditions
(B) Prolonged low temperatures followed by sudden warming
(C) Severe deficiency of essential soil phosphorus during early bulb growth
(D) Heavy application of potassic fertilizers throughout the cropping cycle

45. 'Parbhani Kranti' is a highly celebrated and commercially successful variety of okra (bhindi). It was bred primarily to exhibit resistance against which major disease?
(A) Yellow vein mosaic virus
(B) Powdery mildew fungal infection
(C) Vascular Fusarium wilt pathogen
(D) Soil-borne root-knot nematode

46. Cropping intensity is a key indicator of agricultural land utilization. Which formula is correctly used to calculate the cropping intensity of a given area?
(A) (Net Sown Area / Gross Cropped Area) × 100
(B) (Total Production / Gross Cropped Area) × 100
(C) (Gross Cropped Area / Net Sown Area) × 100
(D) (Net Sown Area / Culturable Wasteland) × 100

47. Which of the following statements best describes the primary objective of crop diversification from a risk-reduction perspective?
(A) Shifting entire agricultural regions exclusively to a single high-value commercial cash crop to maximize regional export revenue.
(B) Replacing all local traditional crop varieties with a single genetically modified hybrid across all growing seasons nationwide.
(C) Converting multi-crop agricultural lands entirely into permanent livestock grazing pastures to increase dairy product yields.
(D) Growing multiple crop types to mitigate market price volatility or single-crop failure risks.

48. Consider the following statements regarding the nutritional properties of millets (coarse grains), which justify their inclusion in the Shree Anna campaign:
I. They are naturally gluten-free.
II. They have a low glycemic index, making them suitable for diabetic management.
III. They possess extremely low dietary fibre compared to polished rice.
IV. They are rich in micronutrients like iron, calcium, and zinc.
Which of the above statement(s) is/are correct?
(A) I, II and IV only
(B) I, II and III only
(C) II, III and IV only
(D) I, III and IV only

49. When comparing local/indigenous varieties with hybrid varieties, hybrid varieties generally exhibit 'heterosis'. What does the term heterosis refer to in agricultural genetics?
(A) The natural tendency of hybrid offspring to revert strictly to phenotypic traits of the female parent plant
(B) Superior performance of F1 hybrids over their inbred parents
(C) The rapid mutation of seed genetic material when crops are directly exposed to intense solar radiation
(D) The gradual loss of crop yield over successive plant generations in naturally self-pollinated field crops

50. In the context of seed management, what does the term 'Seed Replacement Rate' (SRR) signify?
(A) The percentage of commercial seed lots that fail to germinate under standardized laboratory field testing conditions
(B) The rate at which traditional crop seeds are substituted with chemical fertilizers in nutrient-deficient soils
(C) The speed at which traditional landrace seed varieties are genetically engineered in specialized biotechnology laboratories
(D) The percentage of cropped area sown with certified seeds instead of farm-saved seeds

51. Given below are two statements, one labeled as Assertion (A) and the other labeled as Reason (R):
Assertion (A): Continuous monocropping of the same crop year after year on a piece of land inevitably leads to a decline in soil health and crop productivity.
Reason (R): Monocropping extracts the same specific nutrients from the same soil depth repeatedly, leading to targeted nutrient depletion and the buildup of crop-specific pests and soil-borne diseases.
In the light of the above statements, choose the correct answer from the options given below:
(A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
(B) Both Assertion (A) and Reason (R) are true but R is not the correct explanation of A.
(C) Assertion (A) is true but Reason (R) is false.
(D) Assertion (A) is false but Reason (R) is true.

52. What is the defining technical difference between 'Mixed Cropping' and 'Intercropping'?
(A) Intercropping is practiced exclusively during the Kharif season, while mixed cropping systems are strictly confined to the Rabi season.
(B) Mixed cropping requires all companion crops to be of the exact same height, whereas intercropping requires contrasting plant canopy heights.
(C) Mixed cropping has no row arrangement, while intercropping grows crops in definite rows.
(D) Mixed cropping is practiced solely for livestock fodder production, while intercropping is undertaken exclusively for commercial cash crops.

53. If the regular main crop fails due to adverse climatic conditions like early drought or flooding, a short-duration crop planted quickly to utilize the remaining season is technically called a:
(A) Catch crop
(B) Trap crop

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(C) Cash crop
(D) Cover crop

54. Based on soil variations, rainfall, temperature, and topography, the state of Uttar Pradesh has been broadly classified into how many distinct agro-climatic zones?
(A) 5
(B) 9
(C) 15
(D) 20

55. Arrange the physiological growth stages of the sugarcane crop in the correct chronological order from planting to harvest:
I. Grand Growth Phase
II. Germination Phase
III. Maturity and Ripening Phase
IV. Tillering Phase
(A) II, IV, I, III
(B) II, I, IV, III
(C) IV, II, I, III
(D) II, IV, III, I

56. The 'Tarai' agro-climatic region of Uttar Pradesh is known for its high productivity in sugarcane and paddy. Which of the following is a characteristic feature of the soils in the Tarai region?
(A) Deep black cotton clay soils prone to severe deep cracking during dry summer months
(B) Highly arid, loose sandy soils characterized by extremely poor water retention capacity
(C) Red lateritic weathered soils exhibiting extreme acidity and low native soil fertility
(D) Organic-rich alluvial soils with a high water table

57. The Planning Commission of India (now NITI Aayog) fundamentally categorized the entire geographical area of the country into how many major agro-climatic zones?
(A) 8
(B) 10
(C) 15
(D) 21

58. Consider the following statements regarding the inclusion of pulse crops in a cereal-dominated cropping system for diversification:
I. It interrupts pest and disease cycles inherent in continuous cereal cropping.
II. It requires massive applications of synthetic nitrogenous fertilizers.
III. It improves the physical and chemical properties of the soil by adding organic matter and fixing atmospheric nitrogen.
Which of the above statement(s) is/are correct?
(A) I and II only
(B) I and III only
(C) II and III only
(D) I, II and III

59. What is the standard recommended seed rate for planting one hectare of sugarcane using 3-budded setts under flat-bed conventional planting?
(A) 10,000 to 15,000 setts
(B) 35,000 to 40,000 setts
(C) 70,000 to 75,000 setts
(D) 1,00,000 to 1,20,000 setts

60. The 'Trench method' of planting sugarcane is heavily promoted in specific regions. What is the principal agronomic advantage of this method?
(A) It completely eliminates the necessity for any synthetic chemical fertilizer applications throughout the season.
(B) It saves irrigation water and reduces crop lodging.
(C) It ensures that the standing sugarcane crop matures completely within a short span of four months from planting.
(D) It completely prevents any occurrence or incidence of fungal red rot disease in susceptible cane cultivars.

61. Ratoon Stunting Disease (RSD) severely affects the yield of ratoon sugarcane crops. This disease is caused by which class of pathogen?
(A) A xylem-inhabiting bacterium
(B) A highly contagious wind-borne foliar fungus
(C) A persistent soil-borne parasitic root nematode
(D) A sap-transmissible systemic plant viroid

62. A sugarcane field exhibits plants where the central leaf whorl has dried up, forming a characteristic 'dead heart', and the unfolding leaves show parallel 'shot holes'. These are classic damage symptoms of which major pest?
(A) Sugarcane Pyrilla
(B) Early Shoot Borer
(C) Top Borer
(D) Termites

63. Match the major crops (List I) with their widely recommended specific chemical weedicides (List II).

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List I: (Crop)
P. Wheat
Q. Sugarcane
R. Paddy (Transplanted)
S. Pulses
List II: (Weedicide)
1. Butachlor
2. Atrazine
3. Isoproturon
4. Fluchloralin (Basalin)
(A) P-3, Q-2, R-1, S-4
(B) P-2, Q-3, R-4, S-1
(C) P-3, Q-1, R-2, S-4
(D) P-1, Q-2, R-3, S-4

64. 'Propping' or tying up of sugarcane is an important cultural operation performed in the latter stages of crop growth. What is the sole purpose of this practice?
(A) To protect the upper green leaf canopy from severe winter frost damage
(B) To mechanically increase the length and girth of individual internodes
(C) To prevent lodging caused by winds and waterlogging
(D) To completely stop subterranean attacks of root-boring insect pests

65. In standard sugarcane cultivation, the practice of 'earthing up' (Mitti chadhana) is typically recommended to be completed at what stage of crop growth?
(A) Immediately during field preparation at the exact time of sett planting
(B) Within 15 to 20 days after planting during initial bud germination
(C) At 100 to 120 days after planting
(D) Exactly 15 days prior to commencing the final crop harvesting operations

66. How is the 'Sugar Recovery Percentage' calculated by a sugar mill during the crushing season?
(A) (Weight of sugar produced / Volume of juice extracted) $\times$ 100
(B) (Weight of sugarcane crushed / Weight of sugar produced) $\times$ 100
(C) (Volume of juice extracted / Weight of sugarcane crushed) $\times$ 100
(D) (Weight of sugar produced / Weight of sugarcane crushed) $\times$ 100

67. Consider the following statements regarding the institutional framework of the sugarcane sector in Uttar Pradesh:
I. The 'Purchi' (supply ticket) system aims to ensure an equitable and transparent scheduling of cane supply by farmers to the sugar mills.
II. The State Advised Price (SAP) for sugarcane is declared independently by the Uttar Pradesh State Government.
III. The Fair and Remunerative Price (FRP) is structurally bound to a basic minimum sugar recovery rate.
IV. Cooperative Cane Development Societies strictly manufacture sugar and do not participate in seed or fertilizer distribution.
Which of the above statement(s) is/are correct?
(A) I, II and IV only
(B) II, III and IV only
(C) I, II and III only
(D) I, III and IV only

68. Historically and operationally, the main sugarcane crushing season for sugar mills in Uttar Pradesh generally commences in which months?
(A) February - March
(B) June - July
(C) October - November
(D) August - September

69. A 'Crop Calendar' is an essential tool for farm management. What vital information does it primarily depict?
(A) The schedule of sowing, cultural, and harvesting activities for crops throughout the year
(B) The daily wholesale market price fluctuations of major commercial agricultural cash crops
(C) The detailed financial balance sheet and annual operating audit of a primary farmers' cooperative
(D) The cumulative historical data regarding agrarian land tenure reforms implemented across the state

70. Although maize is traditionally a Kharif crop, its successful commercial cultivation during the Rabi season is predominantly practiced in which specific agro-climatic sector of Uttar Pradesh?
(A) Bundelkhand drought-prone region
(B) Western UP (Mathura-Agra belt)
(C) Southern Vindhyan hilly range
(D) Eastern UP region

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71. Linseed (Alsi) is an important Rabi crop known for being a 'dual-purpose' crop. What are the two primary commercial products obtained from a dual-purpose linseed crop?
(A) Edible oil and essential aromatic oil
(B) Seed oil and stem fibre (flax)
(C) Fodder and green manure
(D) Sugar and animal feed

72. Consider the following statements regarding the status of the horticulture sector in Uttar Pradesh:
I. Uttar Pradesh is one of the leading mango-producing states in India.
II. The Agra, Farrukhabad, and Kannauj belt is highly recognized for intensive commercial potato cultivation.
III. Apple and walnut orcharding forms the backbone of horticultural income in the Bundelkhand region.
Which of the above statement(s) is/are correct?
(A) I and II only
(B) II and III only
(C) I and III only
(D) I, II and III

73. 'Ergot' is a toxic fungal disease that affects the ovaries of the florets, transforming them into dark, hard structures called sclerotia. This disease is most prominently associated with which millet crop?
(A) Sorghum (Jowar)
(B) Finger millet (Ragi)
(C) Proso millet (Cheena)
(D) Pearl millet (Bajra)

74. Among all the commonly consumed millets and cereals, which of the following is nutritionally distinguished for having the highest calcium content (approx. 344 mg/100g)?
(A) Finger millet (Ragi)
(B) Sorghum (Jowar)
(C) Pearl millet (Bajra)
(D) Maize

75. Which of the following is the defining characteristic of a Zaid crop?
(A) It is strictly a rainfed monsoon crop grown during peak rainy months under high humidity conditions.
(B) A short-duration crop grown during summer months (March to June) under irrigation.
(C) It is a long-duration crop requiring low temperatures and grown during peak winter frost months.
(D) It is a perennial woody plantation crop grown exclusively in high-altitude tropical hilly terrains.

76. Given below are two statements, one labeled as Assertion (A) and the other labeled as Reason (R):
Assertion (A): Intercropping short-duration legumes like moong or urad in the inter-row spaces of sugarcane is highly recommended.
Reason (R): Sugarcane possesses specialized root nodules that directly fix atmospheric nitrogen to feed the legume crop.
In the light of the above statements, choose the correct answer from the options given below:
(A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
(B) Both Assertion (A) and Reason (R) are true but R is not the correct explanation of A.
(C) Assertion (A) is true but Reason (R) is false.
(D) Assertion (A) is false but Reason (R) is true.

77. Sugarcane trash mulching in the ratoon crop is a widely recommended agronomic practice. What is its primary agronomic benefit?
(A) It suppresses weed growth and conserves soil moisture.
(B) It accelerates the rapid depletion of profile soil moisture to prevent fungal root rot diseases.
(C) It provides an ideal microclimate and breeding ground for destructive early shoot borer pests.
(D) It reflects solar radiation to prevent standing sugarcane from photosynthesizing too rapidly.

78. Which of the following specific biofertilizers is highly recommended for endophytic nitrogen fixation in sugarcane crops to reduce the dependency on chemical urea?
(A) Rhizobium leguminosarum species complex
(B) Azolla pinnata aquatic fern biofertilizer
(C) Gluconacetobacter diazotrophicus
(D) Frankia actinorhizal symbiont complex

79. Sunnhemp (San) is widely utilized as an excellent green manuring crop before planting a main crop. At what stage of its growth should the sunnhemp crop ideally be turned/incorporated into the soil for maximum nitrogen and organic matter benefit?
(A) At the early seedling stage (10-15 days)

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(B) At the flowering stage (approx. 45-50 days)
(C) After full pod formation and maturity
(D) Only after it has completely dried naturally in the field

80. When a mature sugarcane crop transitions from the vegetative to the reproductive phase, it produces a terminal inflorescence. What is this inflorescence technically called in agricultural terminology?
(A) Tassel
(B) Ear
(C) Arrow
(D) Panicle

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ANSWERS

1. (B) As a biennial or perennial crop grown as an annual cash crop for its stem
Sugarcane botanically belongs to the grass family Poaceae and naturally functions as a perennial plant. However, in standard agricultural practice, it is cultivated as an annual cash crop. The vegetative stems or stalks store sucrose, which is harvested after twelve to eighteen months of growth to serve as primary raw material for sugar production.

2. (D) Sown in June-July and harvested in September-October
The Kharif cropping season in Uttar Pradesh coincides with the arrival of the south-west monsoon rains. Sowing typically begins in June or July when soil moisture is optimal for germination. These monsoon crops undergo vegetative growth during the high humidity summer months and are systematically harvested at maturity between September and October before the winter season starts.

3. (A) It is an early to mid-late maturing, high-yielding and high-sugar recovery variety.
Developed by the Sugarcane Breeding Institute Regional Centre in Karnal, Co 0238 is a landmark sugarcane variety widely adopted across northern India. It is recognized for its early to mid-late maturity, exceptional cane yield potential, and superior sucrose content. Its widespread cultivation significantly boosted sugar recovery percentages in factories throughout Uttar Pradesh over the past decade.

4. (A) P-2, Q-3, R-4, S-1
Botanical names accurately classify crops within plant taxonomy. Wheat belongs to the grass family and is designated as Triticum aestivum. Paddy or Asian rice is botanically named Oryza sativa. Pigeon pea or Arhar is a pulse crop known as Cajanus cajan, whereas commercial cultivated sugarcane is scientifically named Saccharum officinarum within the family Poaceae.

5. (C) 125 kg per hectare
Sowing wheat late in Uttar Pradesh reduces the total vegetative growth window due to rising spring temperatures. To compensate for reduced tillering time and maintain the required plant density per unit area, the standard seed rate is increased from 100 kg per hectare used in timely sown conditions to 125 kg per hectare for late-sown fields.

6. (D) Paddy
The Dapog method is an intensive nursery raising technique developed in the Philippines and widely used for paddy cultivation. Seedlings are raised on a non-soil surface like plastic sheets or concrete floors using pre-germinated seeds. This approach allows paddy seedlings to become ready for field transplanting within nine to fourteen days with minimal land requirement.

7. (A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
Autumn-planted sugarcane in Uttar Pradesh yields higher cane tonnage and sugar recovery than spring-planted cane. Planting in October gives the crop several extra months of growth prior to monsoon rains. This extended duration allows robust tillering during spring and an expanded grand growth period, directly establishing a strong scientific relationship between prolonged growth duration and superior final economic yields.

8. (C) Critical tasseling and silking stage
Tasseling and silking represent the critical reproductive stages in maize cultivation where flower formation and fertilization occur. Any water stress during this phase severely impairs pollen viability, silk elongation, and kernel formation. Proper irrigation management at tasseling and silking prevents moisture stress, thereby protecting crop yield potential from catastrophic losses caused by incomplete grain filling.

9. (D) To remove the terminal apical bud to encourage lateral branching
Nipping is an essential agronomic intervention performed in gram cultivation around 30 to 45 days after sowing. It involves plucking the growing apical tip of the main shoot. Removing apical dominance stimulates intense lateral branching and bushier growth, which substantially increases

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the number of flowering sites, pod formation, and total seed yield per plant.

10. (A) Lentil (Masoor)
Lentil is strictly classified as a winter or Rabi pulse crop, requiring cool thermal conditions during vegetative growth and warm weather during maturity. Conversely, green gram, black gram, and pigeon pea are adaptable to Kharif monsoon conditions. Lentils cannot tolerate high heat and excessive rainfall, making their cultivation unsuitable for the Kharif growing season.

11. (B) 12-15 kg per hectare
Sowing pigeon pea as a pure line crop requires an optimum seed rate of 12 to 15 kg per hectare to achieve target plant density. Proper spacing ensures adequate air circulation and sunlight interception among branches. Maintaining this seeding quantity ensures balanced canopy development without inducing excessive inter-plant competition or reduced pod development.

12. (A) I and II only
Pulse crops possess specialized root nodules housing Rhizobium bacteria, enabling biological atmospheric nitrogen fixation directly into soil root zones. However, Rajmash lacks nodulation capacity and requires external nitrogen supplementation. Biological nitrogen fixation occurs in root nodules rather than foliar leaf tissue during photosynthesis, invalidating claims of foliar fixation while confirming symbiotic soil nutrient enrichment.

13. (C) 38 - 43%
Rapeseed and mustard are principal winter oilseed crops cultivated across Uttar Pradesh. Improved Indian mustard cultivars systematically yield a seed oil concentration ranging between 38 and 43 percent under optimal agronomic practices. Oil yield depend heavily on genetic potential, balanced sulfur application, adequate soil moisture, and cool temperatures during the seed filling stage.

14. (C) Leafhopper
Phyllody in sesame is caused by a phytoplasma pathogen that converts normal floral parts into green, sterile leaf-like structures, leading to total yield loss. This destructive pathogen is vector-transmitted from infected plants to healthy crops primarily by the sesame leafhopper (Orosius orientalis). Effective vector control remains essential for managing disease spread.

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15. (D) To promote proper pod and kernel development
Pegging represents a crucial developmental stage in groundnut where fertilized flowers form pegs that penetrate the soil to develop pods. Gypsum application supplies readily available calcium and sulfur directly to the pegging zone. Calcium absorption by developing subterranean pegs prevents empty pods or pop formation, promoting proper seed kernel development.

16. (C) Day-neutral plant
Sunflower (Helianthus annuus) is physiologically classified as a day-neutral plant. Photoperiodic neutrality means that floral initiation and flowering timing are not dictated by specific day lengths or night durations. Consequently, sunflower crops can be successfully cultivated in all three agricultural seasons—Kharif, Rabi, and Zaid—wherever adequate moisture and warmth exist in field environments.

17. (B) Hydrocyanic acid
Young sorghum fodder contains the cyanogenic glucoside dhurrin, which hydrolyzes in animal rumens into toxic hydrocyanic acid (HCN) or prussic acid. HCN concentrations peak in early growth stages under drought stress. Feeding immature sorghum before 45 to 50 days or before flowering causes acute toxicity, respiratory failure, and death in livestock.

18. (A) Uttar Pradesh > Maharashtra > Karnataka > Tamil Nadu
India is a global leader in sugarcane cultivation, with production concentrated in subtropical and tropical states. Uttar Pradesh consistently ranks first nationwide in total sugarcane output due to extensive cultivated acreage in alluvial plains, followed by Maharashtra, Karnataka, and Tamil Nadu. This sequence accurately reflects official agricultural production ranking statistics.

19. (A) Millets and coarse cereals
The Government of India initiated the 'Shree Anna' campaign to promote millets and coarse grains, including sorghum, pearl millet, finger millet, and minor millets. The initiative aims to enhance public nutritional security, boost climate-resilient farming, increase farmer

incomes, and position India as a global hub for sustainable millet consumption and production.

20. (B) 30 - 35%
Ginning is the mechanical process of separating raw cotton seed cotton (kapas) into clean lint fibers and seed. Ginning percentage expresses the proportion of lint weight obtained relative to total seed cotton weight. Standard cultivated cotton varieties in India typically possess a ginning turnout percentage ranging between 30 and 35 percent.

21. (C) 32°C - 34°C
Retting is a controlled biological process where micro-organisms decompose pectins and gums binding jute fibers to woody stalks. Water temperature strongly regulates bacterial enzyme activity during retting. Maintaining an optimal water temperature of 32°C to 34°C ensures complete bacterial degradation, high fiber extraction efficiency, and optimal commercial fiber quality output.

22. (A) P-2, Q-4, R-3, S-1
Plant taxonomy groups crop species according to shared evolutionary characteristics. Sugarcane belongs to the grass family Poaceae, while mustard is classified under Brassicaceae. Coriander is an aromatic seed spice in Apiaceae, and potato is a nightshade tuber crop belonging to Solanaceae. These taxonomic classifications define physiological traits and growth habits.

23. (B) To divert energy toward leaf growth
Topping removes the terminal flower head, while desuckering eliminates auxiliary side shoots in growing tobacco plants. Halting reproductive flowering and vegetative lateral shoot development redirects photosynthates directly into commercial leaves. This targeted energy reallocation expands leaf surface area, increases leaf thickness, and enhances total nicotine content and leaf commercial quality.

24. (B) I, II and III only
Sugarcane maturity is evaluated through physiological indices. A hand-refractometer Brix value of 18 to 20 percent indicates high soluble solids. Glucose levels dropping below 0.5 percent signify conversion of reducing sugars to sucrose, and equalized top and bottom Brix readings confirm complete cane ripening. Stem moisture, however, remains near 70 percent.

25. (D) Curcumin
Turmeric (Curcuma longa) is a prized spice crop whose underground rhizomes possess characteristic bright yellow pigmentation and therapeutic medicinal virtues. These attributes are driven by curcumin, a bioactive polyphenolic compound. Curcumin exhibits strong antioxidant, anti-inflammatory, and antimicrobial activity, making turmeric commercially valuable for pharmaceutical, culinary, and cosmetic applications across global trade markets.

26. (A) Splitting seeds into two mericarps to enhance germination
The biological seed unit in coriander (Coriandrum sativum) is a schizocarp composed of two joined single-seeded mericarps. Lightly crushing or rubbing intact seeds prior to planting separates the fruit into individual mericarps. This pre-sowing mechanical splitting significantly accelerates moisture absorption, breaks pericarp resistance, and ensures rapid, uniform field germination rates.

27. (B) Leaves and tender stems
Japanese Mint (Mentha arvensis) is an essential commercial aromatic crop grown in Uttar Pradesh. Menthol oil is synthesized and stored in specialized glandular trichomes located on the surface of green leaves and tender young stems. Steam distillation of fresh aboveground herb biomass yields mentha oil, rich in menthol for industrial uses.

28. (B) Cloves
Garlic (Allium sativum) is sterile and rarely forms viable seed heads under normal cultivation. Consequently, commercial propagation relies strictly on vegetative material. Individual segments of the compound bulb, known as cloves, serve as standard planting units. Planted cloves sprout readily to establish roots and produce identical garlic plants in field conditions.

29. (A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
Long-duration pigeon pea varieties in western Uttar Pradesh mature during winter, overlapping with winter frost events in December and January. Frost exposure freezes cellular fluids within delicate floral organs and developing pods, causing severe necrosis and reproductive failure. Thus, frost susceptibility directly explains the

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heightened risk of crop loss in long-duration pigeon pea.

30. (C) Rhizobium trifolii
Berseem (Trifolium alexandrinum) is a high-quality forage legume widely grown during the Rabi season. Establishing effective root nodules for atmospheric nitrogen fixation requires inoculating seeds with host-specific biofertilizer bacteria. Rhizobium trifolii is the specific bacterial strain tailored for clover species like berseem, enhancing root nodulation, nitrogen fixation, and forage biomass yield.

31. (D) Through root slips or stem cuttings
Napier grass or Elephant grass (Pennisetum purpureum) is a robust perennial fodder grass. Due to high genetic heterozygosity and poor seed setting, viable seeds are rarely produced for commercial propagation. Consequently, vegetative propagation using rooted slips or stem cuttings with two to three nodes is universally practiced to ensure rapid field establishment.

32. (C) UPO-212
Oats (Avena sativa) serve as a valuable winter forage crop in livestock farming systems. UPO-212 is a well-known multi-cut oat variety developed by Pantnagar University. It possesses high tillering capacity and fast regrowth ability, allowing farmers to take multiple cuttings of nutritious green fodder throughout the Rabi winter cropping season.

33. (B) Malihabad (Lucknow)
The 'Dashehari' mango variety originated in Dashehari village near Malihabad in Lucknow district, Uttar Pradesh. Malihabad is globally celebrated for its extensive fruit orchards producing high-quality Dashehari mangoes characterized by fiberless, sweet pulp and pleasant aroma. The region officially holds Geographical Indication status for this famous subtropical commercial fruit cultivar.

34. (C) 2.0 m x 1.0 m
Meadow Orcharding in guava (Ψdium guajava) was developed at the Central Institute for Subtropical Horticulture in Lucknow to maximize yield per unit area. Under this ultra-high-density planting system, guava plants are spaced at 2.0 meters between rows and 1.0 meter between plants, accommodating 5,000 plants per hectare with regular canopy topping.

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35. (D) I, II and III
Red Rot is a devastating fungal disease of sugarcane caused by Colletotrichum falcatum. Infected canes display internal reddening with characteristic white cross-wise patches and emit a distinct sour alcoholic odor when split open. The pathogen primary spreads through infected seed setts, making seed sanitation and clean planting material essential for disease management.

36. (C) A leaf-spotting fungus
Sigatoka is an extremely destructive foliar disease affecting commercial banana production globally. It is caused by leaf-spotting fungal pathogens belonging to the genus Mycosphaerella (Mycosphaerella musicola or Mycosphaerella fijiensis). The fungus creates severe necrotic leaf spots, reducing photosynthetic leaf area, leading to premature leaf death and reduced final fruit yield.

37. (A) Xanthomonas citri
Citrus Canker is a severe bacterial disease infecting citrus crops including lime, lemon, and orange species. The causal bacterial agent is Xanthomonas citri (or Xanthomonas axonopodis pv. citri). The bacterium induces raised, corky, crater-like necrotic lesions on leaves, twigs, and fruits, causing premature fruit drop and unmarketable crop produce yields.

38. (D) October - November
In the plains of North India, including Uttar Pradesh, annual pruning of commercial rose bushes is conducted during October and November. Pruning removes old, diseased, and crisscrossing branches after the monsoon season. This timing stimulates dormant vegetative buds to produce vigorous new shoots, ensuring rich flowering during peak winter months.

39. (B) 1.0 - 1.5 kg
African Marigold (Tagetes erecta) is a popular floriculture crop cultivated for loose flowers and garland production. To raise sufficient healthy seedlings for transplanting one hectare of land, a standard seed rate of 1.0 to 1.5 kg per hectare is required. Proper nursery bed care produces strong, disease-free field transplanting seedlings.

40. (A) Wheat > Paddy > Maize > Pearl Millet (Bajra)
Uttar Pradesh is the highest food-grain producing state in India. Wheat dominates

state production volume, occupying the largest cropped area during the Rabi season. Paddy ranks second as the primary Kharif staple crop, followed by maize and pearl millet. This ranking reflects official agricultural production volume statistics across Uttar Pradesh.

41. (A) 100 - 150 grams
True Potato Seed (TPS) technology utilizes botanical seeds harvested from potato berries rather than bulky seed tubers. While traditional tuber planting requires around 25 to 30 quintals per hectare, TPS requires only 100 to 150 grams per hectare. TPS drastically lowers storage, transportation, and disease transmission risks for potato growers.

42. (A) Whitefly (Bemisia tabaci)
Tomato Leaf Curl Virus is a major viral disease affecting tomato crops, causing severe leaf curling, chlorosis, and stunting. The virus is transmitted persistent-systemically by the whitefly insect vector (Bemisia tabaci). Managing whitefly populations using insect-proof nurseries, yellow sticky traps, and systemic insecticides is key to preventing crop virus spread.

43. (A) P-2, Q-1, R-4, S-3
Agricultural research institutes specialize in crop breeding and agronomy. The ICAR-Indian Institute of Sugarcane Research is situated in Lucknow, UP. The U.P. Council of Sugarcane Research is headquartered in Shahjahanpur. The ICAR-Sugarcane Breeding Institute operates in Coimbatore, Tamil Nadu, and the Vasantdada Sugar Institute is an autonomous institute based in Pune, Maharashtra.

44. (B) Prolonged low temperatures followed by sudden warming
Bolting in onion refers to premature reproductive stalk emergence prior to bulb enlargement, leading to woody, unmarketable bulbs. Temperature fluctuations primarily drive bolting. Prolonged cool temperatures below 10°C to 15°C induce vernalization in young plants, which subsequently triggers rapid flower stalk emergence when temperatures rise, spoiling total bulb yield quality.

45. (A) Yellow vein mosaic virus
'Parbhani Kranti' is a landmark yellow vein mosaic virus (YVMV) resistant okra cultivar developed at Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani. It was bred by crossing the cultivated okra Abelmoschus esculentus with the wild resistant species Abelmoschus manihot. Its genetic resistance protects yields from devastating whitefly-vectored crop YVMV virus infection.

46. (C) (Gross Cropped Area / Net Sown Area) × 100
Cropping intensity measures the frequency with which land is cultivated within a single agricultural year. It is calculated by dividing Gross Cropped Area (the sum of areas under all crops grown across seasons, including multiple cropping) by Net Sown Area (the actual physical land footprint) and multiplying the result by 100.

47. (D) Growing multiple crop types to mitigate market price volatility or single-crop failure risks.
Crop diversification involves transitioning from monoculture to growing multiple species or varieties with varied growth cycles and water requirements. This strategy reduces vulnerability to unexpected weather anomalies, climate shocks, pest outbreaks, and commodity market price fluctuations. Diversifying crops stabilizes agricultural farm returns, builds ecological resilience, and protects smallholder farmer livelihoods.

48. (A) I, II and IV only
Millets are recognized under the Shree Anna campaign for superior nutritional profiles. They are non-glutinous and possess a low glycemic index, making them ideal for managing diabetes. Additionally, millets contain significant concentrations of dietary fiber and essential minerals like calcium, iron, and zinc, unlike polished grains which lack high fiber and micro-nutrients.

49. (B) Superior performance of F1 hybrids over their inbred parents
Heterosis, commonly known as hybrid vigor, is the phenotypic phenomenon where the first-generation (F1) offspring produced by crossing distinct genetically inbred parental lines exhibit superior vigor, yield potential, growth rate, and stress tolerance relative to both parents. Plant breeders exploit heterosis to develop high-yielding hybrid crop varieties for agricultural production.

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50. (D) The percentage of cropped area sown with certified seeds instead of farm-saved seeds
Seed Replacement Rate (SRR) quantifies the proportion of total cropped area sown with certified or quality seeds relative to farm-saved seeds. Higher SRR values reflect greater adoption of high-yielding, genetically pure, disease-free seed stock, which directly enhances total crop productivity, agricultural performance, and farm yield stability across diverse farming regions.

51. (A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
Continuous monocropping of the same plant species on a given land parcel causes cumulative soil nutrient depletion from a fixed root depth. It also fosters uninterrupted host-pathogen cycles and weed establishment. These specific biological and chemical soil degradation processes directly explain why yield declines and soil health degrades under prolonged monoculture.

52. (C) Mixed cropping has no row arrangement, while intercropping grows crops in definite rows.
Mixed cropping and intercropping both involve cultivating two or more crops simultaneously on the same piece of land. The key distinction lies in spatial arrangement: mixed cropping broadcasts mixed seeds without distinct row arrangements, whereas intercropping plants component crops in definite, organized row patterns to optimize light, water, and nutrient utilization.

53. (A) Catch crop
A catch crop or contingency crop is a fast-growing, short-duration crop planted when a primary main crop fails due to early drought, excessive rainfall, or pest damage. These short-season crops utilize remaining soil moisture and seasonal length to produce yield, preventing economic loss and preventing land from staying uncultivated during crop seasons.

54. (B) 9
Based on variations in climate, rainfall, topography, soil character, and cropping systems, Uttar Pradesh is classified into nine distinct agro-climatic zones. These include Tarai, Western Plain, Central Plain, Eastern Plain, Bundelkhand, and Vindhyan zones. This ecological zoning helps guide region-specific crop planning, irrigation strategies, and agricultural research policy formulation statewide.

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55. (A) II, IV, I, III
The physiological development of sugarcane progresses through four sequential stages following sett planting. Growth begins with the Germination Phase (0-45 days), followed by the Tillering Phase (45-120 days). Next is the Grand Growth Phase (120-270 days) where stalk length expands, concluding with the Maturity and Ripening Phase (270-360 days) accumulating sucrose.

56. (D) Organic-rich alluvial soils with a high water table
The Tarai region along the Himalayan foothills in Uttar Pradesh features dark alluvial soils rich in organic matter. Clay loam texture combined with sub-surface seepage creates high water tables and excellent soil moisture retention. These fertile conditions support demanding crops like sugarcane and paddy, which thrive under high water availability.

57. (C) 15
The Planning Commission of India delineated the nation into 15 distinct Agro-Climatic Zones based on physical topography, rainfall distribution, thermal regimes, soil profiles, and cropping patterns. Uttar Pradesh predominantly falls within three of these national zones: the Trans-Gangetic Plain Region, Middle Gangetic Plain Region, and Upper Gangetic Plain Region territories.

58. (B) I and III only
Integrating legumes into cereal-dominated cropping systems breaks persistent weed, pest, and disease life cycles. Symbiotic Rhizobium bacteria in leguminous root nodules fix atmospheric nitrogen into the soil, reducing synthetic nitrogen fertilizer requirements. Furthermore, biomass decomposition enhances soil organic matter content, soil structure, and chemical nutrient availability for succeeding crop plants.

59. (B) 35,000 to 40,000 setts
Standard flat-bed sugarcane planting under conventional row spacing (75 to 90 cm) requires 35,000 to 40,000 three-budded setts per hectare, equivalent to 7 to 8 tonnes of seed cane. This seeding rate ensures target stalk density after accounting for typical germination rates, establishing a dense plant canopy across field rows.

60. (B) It saves irrigation water and reduces crop lodging.
Deep trench sugarcane planting places seed setts in 25-30 cm furrows, concentrating applied irrigation water and reducing evaporation losses relative to surface flooding. Earthing up soil into trenches as plants grow buries roots deeply and provides anchorage. This structural root support protects tall, heavy sugarcane crops from wind-induced field lodging.

61. (A) A xylem-inhabiting bacterium
Ratoon Stunting Disease (RSD) is a major sugarcane vascular disease caused by the xylem-inhabiting fastidious bacterium Leifsonia xyli subsp. xyli. The bacterium multiplies within vascular xylem vessels, restricting water and nutrient transport. This systemic infection causes stunted growth, reduced tillering, and severe yield degradation, particularly in ratoon sugarcane crop fields.

62. (C) Top Borer
Top Borer (Scirpophaga excerptalis) larvae bore into young terminal shoots of sugarcane, destroying central vascular growing points and producing dried central leaves known as 'dead heart'. Larval feeding through emerging, rolled leaves produces characteristic parallel rows of shot holes upon unfurling, causing side branching known as 'bunchy top' crop symptoms.

63. (A) P-3, Q-2, R-1, S-4
Selective chemical weed control relies on crop-herbicide compatibility. Isoproturon targets grassy weeds in wheat, while Atrazine controls broadleaf weeds in sugarcane fields. Butachlor is a pre-emergence herbicide used in transplanted paddy to manage barnyard grass, and Fluchloralin (Basalin) is incorporated pre-plant into pulse soils for effective weed management crop protection.

64. (C) To prevent lodging caused by winds and waterlogging
Propping in sugarcane involves binding living stalks together using lower dry leaves during late vegetative growth stages. This cultural practice creates interconnected mechanical supports across rows, stabilizing tall, heavy sugarcane stalks against strong winds, wet monsoon soils, and field waterlogging. Propping prevents crop lodging and protects final harvested cane yields.

65. (C) At 100 to 120 days after planting
Earthing up in sugarcane involves mounding soil around the base of plants. The major earthing up is timed at 100 to 120 days after planting, coinciding with the end of tillering and start of stalk elongation. This operation smothers late-emerging weeds, suppresses late unwanted tillers, and stabilizes roots against lodging.

66. (D) (Weight of sugar produced / Weight of sugarcane crushed) $\times$ 100
Sugar Recovery Percentage measures mill efficiency in converting raw sugarcane into refined commercial sugar. It is calculated by dividing total weight of sugar produced during crushing by total weight of raw sugarcane crushed, expressed as a percentage. Higher recovery rates reflect higher sucrose content and superior processing performance in sugar mills.

67. (C) I, II and III only
The sugarcane institutional framework in Uttar Pradesh uses the 'Purchi' system to schedule cane delivery transparently. State Advised Price (SAP) is declared independently by state authorities, while Central Fair and Remunerative Price (FRP) links to base recovery rates. Cooperative Cane Societies manage supply scheduling and actively distribute inputs like seeds and fertilizers.

68. (C) October - November
Sugar mill crushing in Uttar Pradesh starts in October or November as autumn temperatures drop and sugarcane reaches commercial maturity with high sucrose accumulation. Crushing operates through winter and spring until April or May. Starting in October-November aligns factory operations with peak sucrose levels and ideal post-monsoon harvesting field conditions.

69. (A) The schedule of sowing, cultural, and harvesting activities for crops throughout the year
A Crop Calendar is a practical farm planning tool outlining the precise timeline of field operations for various crops across the agricultural year. It details optimal dates for land preparation, sowing, irrigation schedules, fertilizer applications, plant protection measures, and harvesting, guiding farmers to optimize resource use and maximize annual crop yields.

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70. (D) Eastern UP region
Although maize is predominantly grown during the Kharif monsoon season, its commercial cultivation during the Rabi winter season has expanded significantly in Eastern Uttar Pradesh. Mild winter temperatures, fertile alluvial soils, and adequate irrigation infrastructure in Eastern UP create optimal conditions for high-yielding winter maize production with low disease pressure.

71. (B) Seed oil and stem fibre (flax)
Linseed (Linum usitatissimum) is a versatile Rabi crop valued as a dual-purpose oilseed and fibre crop. Its seeds yield linseed oil, rich in omega-3 fatty acids for culinary and industrial uses like paints and varnishes. Additionally, the bast fibers extracted from its stems produce high-quality natural flax fiber for linen textiles.

72. (A) I and II only
Uttar Pradesh is a major producer of horticultural crops in India. The state ranks first in mango production with major belts like Malihabad. The Agra, Farrukhabad, and Kannauj belt is widely recognized for intensive commercial potato production. However, cold-climate temperate fruits like apples and walnuts are unsuitable for the semi-arid Bundelkhand region.

73. (D) Pearl millet (Bajra)
Ergot is a serious fungal disease caused by Claviceps fusiformis, primarily affecting pearl millet (Pennisetum glaucum). The fungal pathogen infects florets during flowering, exuding sweet honey-dew droplets before replacing grains with dark, toxic fungal sclerotia containing harmful alkaloids. These alkaloids pose severe health risks to livestock and human grain consumers.

74. (A) Finger millet (Ragi)
Finger millet (Eleusine coracana), commonly known as Ragi, is nutritionally outstanding among food grains for its extraordinary calcium content. It contains approximately 344 mg of elemental calcium per 100 grams of grain, which is roughly five to ten times higher than maize, sorghum, wheat, or rice, supporting human bone health.

75. (B) A short-duration crop grown during summer months (March to June) under irrigation.
Zaid represents the short summer cropping season sandwiched between the Rabi harvest and Kharif sowing (March to June). Zaid crops are fast-maturing, warmth-loving plants grown under artificial irrigation. Typical examples include cucurbits like watermelon, muskmelon, and cucumber, as well as short-duration pulses like moong and urad that thrive in dry heat.

76. (C) Assertion (A) is true but Reason (R) is false.
Intercropping short-duration legumes like moong or urad in sugarcane inter-rows is a highly recommended practice, providing weed suppression and additional income before sugarcane achieves canopy closure. However, sugarcane is a grass and lacks root nodules, whereas the legume companion crop fixes atmospheric nitrogen through its own symbiotic Rhizobium bacterial root nodules.

77. (A) It suppresses weed growth and conserves soil moisture.
Retaining and spreading dried sugarcane leaves (trash) between ratoon sugarcane rows functions as a protective organic mulch. Trash mulching blocks solar radiation, inhibiting weed seed germination and growth while suppressing soil water evaporation. Over time, the decomposing organic mulch enriches soil organic matter and improves overall soil physical structure quality.

78. (C) Gluconacetobacter diazotrophicus
Gluconacetobacter diazotrophicus is a specialized nitrogen-fixing endophytic bacterium that colonizes internal tissues like roots, stems, and leaves of sugarcane. It fixes atmospheric nitrogen internally within sugarcane tissue without forming root nodules. Applying this biofertilizer significantly improves plant nitrogen supply, promoting cane growth and reducing synthetic chemical nitrogen fertilizer dependence levels.

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79. (B) At the flowering stage (approx. 45-50 days)
Sunnhemp (Crotalaria juncea) is widely cultivated as a quick-growing leguminous green manure crop. Incorporating sunnhemp into the soil at 50 to 100 percent flowering (around 45 to 50 days after sowing) yields maximum succulent biomass and succulence. At this stage, tissue carbon-to-nitrogen ratio is balanced, accelerating rapid decomposition and nitrogen release.

80. (C) Arrow

The terminal inflorescence produced when sugarcane transitions from vegetative to reproductive growth is technically termed an 'arrow'. Arrowing transforms the apical vegetative bud into an open, plumose panicle bearing tiny flowers. In commercial cane production, arrowing signals the end of stalk elongation, causing energy reallocation toward flower development rather than sugar accumulation.

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CHAPTER 02

Crop Production Techniques and Agronomic Practices

1. Which of the following best describes the primary objective of deep summer ploughing?
(A) To incorporate large quantities of organic manure into the soil profile
(B) To expose soil-borne pests, pathogens, and weed seeds to intense solar radiation
(C) To create a highly pulverized fine seedbed for immediate crop sowing
(D) To increase the surface runoff of rainwater before the monsoon arrives

2. In sugarcane cultivation, the 'blind hoeing' operation is primarily carried out at which specific stage of crop growth?
(A) Immediately after the earthing up operation
(B) During the late maturity and ripening phase
(C) During the grand growth phase to tie the tall canes together
(D) After planting but before the emergence of the sugarcane sprouts

3. If an agricultural field requires a plant spacing of 60 cm row-to-row and 20 cm plant-to-plant, what will be the approximate expected plant population per hectare under perfect germination conditions?
(A) 63,333 plants
(B) 73,333 plants
(C) 83,333 plants
(D) 93,333 plants

4. Consider the following statements regarding the trench method of sugarcane planting:
I. It is specifically recommended for tall, high-yielding varieties to prevent lodging.
II. It requires significantly less irrigation water compared to the flat-bed planting method.
III. Trenches are typically dug at a shallow depth of 5 to 10 cm.
Which of the above statements is/are correct?
(A) I and II only
(B) II and III only
(C) I and III only
(D) I, II and III

5. In the context of paddy cultivation, which of the following is the primary advantage of the System of Rice Intensification (SRI) over traditional transplanting?
(A) It reduces seed and water requirements while sustaining crop yields.
(B) It completely eliminates the necessity for manual or chemical weed control.
(C) It permits older seedlings of forty to forty-five days to be transplanted.
(D) It relies exclusively on chemical fertilizers while excluding organic inputs.

6. Which chemical is most commonly used for the treatment of sugarcane setts before planting to protect them from soil-borne diseases like red rot and smut?
(A) 2,4-D selective post-emergence herbicide
(B) Imidacloprid systemic broad-spectrum insecticide
(C) Atrazine selective pre-emergence herbicide
(D) Carbendazim or organomercurial fungicides

7. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): Nitrogenous fertilizers should ideally be applied in split doses in cereal crops rather than as a single large basal dose.
Reason (R): Split application minimizes leaching and volatilization losses of nitrogen, ensuring steady availability throughout the crop growth stages.
Select the correct answer using the options below:
(A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
(B) Both Assertion (A) and Reason (R) are true but R is not the correct explanation of A.
(C) Assertion (A) is true but Reason (R) is false.
(D) Assertion (A) is false but Reason (R) is true.

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8. The most critical stage for irrigation in the wheat crop, which occurs approximately 21 days after sowing, is known as:
(A) Booting stage during plant development
(B) Flowering stage during crop growth
(C) Crown Root Initiation (CRI) stage
(D) Dough stage during grain maturation

9. Match List I with List II to choose the correct option:
List I: (Weed Control Method)
P. Mechanical Control
Q. Cultural Control
R. Chemical Control
S. Biological Control
List II: (Specific Example)
1. Using Zygogramma bicolorata for Parthenium
2. Application of Pendimethalin
3. Crop rotation and intercropping
4. Running a cultivator or hoe in the field
(A) P-3, Q-4, R-1, S-2
(B) P-4, Q-2, R-3, S-1
(C) P-2, Q-3, R-4, S-1
(D) P-4, Q-3, R-2, S-1

10. The biological phenomenon where an intercrop provides structural support, shade, or acts as a trap crop for pests without competing aggressively with the main crop is best utilized in which cropping system?
(A) Companion cropping
(B) Relay cropping system
(C) Continuous monocropping
(D) Sequence cropping system

11. Which among the following is considered the most reliable field instrument to determine the maturity of standing sugarcane by measuring the total soluble solids (TSS) in the cane juice?
(A) Digital Hygrometer
(B) Hand Refractometer
(C) Soil Tensiometer
(D) Standard Lactometer

12. Consider the following statements regarding the ring pit method of sugarcane cultivation:
I. It is designed to accommodate a high plant population and produce higher cane yield per unit area.
II. Pits of 90 cm diameter and 45 cm depth are generally excavated for this method.
III. Around 20 to 25 two-budded setts are usually placed in a spoke-like fashion inside each pit.
IV. This method is highly suitable for areas with severe waterlogging and poor drainage.
Which of the above statements is/are incorrect?
(A) I and II only
(B) III and IV only
(C) IV only
(D) I, II and III

13. Earthing up in sugarcane is a crucial intercultural operation. At what stage after planting is the final major earthing up generally recommended to prevent lodging?
(A) 30 to 45 days after planting
(B) 60 to 75 days after planting
(C) 100-120 days after planting
(D) 200 to 220 days after planting

14. What is the standard recommended quantity of three-budded sugarcane setts required to plant one hectare of land under conventional flat-bed planting?
(A) 15,000 to 20,000 setts
(B) 35,000 to 40,000 setts
(C) 55,000 to 60,000 setts
(D) 75,000 to 80,000 setts

15. Which of the following represents the correct sequential order of the physiological growth phases in a standard sugarcane crop from planting to harvest?
(A) Germination phase, Grand growth phase, Formative phase, Maturity phase
(B) Formative phase, Germination phase, Maturity phase, Grand growth phase
(C) Grand growth phase, Germination phase, Formative phase, Maturity phase
(D) Germination phase, Formative phase, Grand growth phase, Maturity phase

16. In terms of spacing, which method of sowing generally provides the most uniform distribution of seeds at a precise depth, leading to optimal plant establishment?
(A) Broadcasting
(B) Dibbling
(C) Seed drill sowing
(D) Aerial broadcasting

17. The use of organic mulch in an agricultural field primarily aids in crop production by:
(A) Accelerating the evaporation of soil moisture
(B) Conserving soil moisture and suppressing weed emergence

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(C) Increasing the reflection of solar radiation to warm the upper canopy
(D) Encouraging the rapid growth of deep-rooted perennial weeds

18. Which modern technique involves the growing of sugarcane seedlings in plastic bags or pro-trays and then transplanting them in the main field to save seed cane and ensure a uniform plant stand?
(A) Ratoon Stunting Prevention Technique
(B) Broad Bed Furrow Irrigation System
(C) Direct Seeded Rice Cultivation System
(D) Spaced Transplanting (STP) Method

19. Consider the following statements about drip irrigation technology:
I. It delivers water directly to the root zone of the plant.
II. It significantly reduces weed growth between crop rows.
III. It cannot be used for the application of water-soluble fertilizers (fertigation).
Which of the above statements is/are correct?
(A) I and II only
(B) II and III only
(C) I and III only
(D) I, II and III

20. The application of Atrazine in a sugarcane field is primarily targeted at controlling which biological constraint?
(A) Soil-borne pathogenic fungal diseases
(B) Underground root borer pest infestation
(C) Broadleaf weeds and annual grasses
(D) Subterranean termite attacks on planted setts

21. Which critical stage of sugarcane growth is highly sensitive to water stress and requires adequate soil moisture to ensure maximum tiller production?
(A) Formative phase
(B) Germination phase
(C) Late grand growth phase
(D) Ripening phase

22. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): Autumn planting of sugarcane gives a higher yield compared to spring planting.
Reason (R): Autumn planted sugarcane gets a longer growing period and better utilizes the pre-monsoon and monsoon periods for grand growth.
Select the correct answer using the options below:
(A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
(B) Both Assertion (A) and Reason (R) are true but R is not the correct explanation of A.
(C) Assertion (A) is true but Reason (R) is false.
(D) Assertion (A) is false but Reason (R) is true.

23. What happens to the physiological development of a crop if the plant population per unit area significantly exceeds the recommended optimum density?
(A) Individual plants show enhanced growth and robust vegetative expansion throughout the field
(B) Mutual shading occurs, causing weak stems and high lodging risk
(C) Deep root proliferation develops rapidly without intra-specific resource competition
(D) Microclimate changes cause total suppression of all insect pests and field diseases

24. A farmer wishes to sow an intercrop with autumn-planted sugarcane to maximize early-season income. Which of the following is a highly recommended intercrop for this specific season?
(A) Pearl Millet (Bajra)
(B) Paddy
(C) Potato
(D) Sorghum (Jowar)

25. Match List I with List II to choose the correct option:
List I: (Agricultural Implement)
P. Mould Board Plough
Q. Rotavator
R. Disc Harrow
S. Seed-cum-Fertilizer Drill
List II: (Primary Function)
1. Clod crushing and secondary tillage
2. Simultaneous placement of seed and fertilizer
3. Soil inversion and primary tillage
4. Pulverizing soil and mixing crop residues in a single pass
(A) P-4, Q-3, R-2, S-1
(B) P-3, Q-1, R-4, S-2
(C) P-2, Q-4, R-1, S-3
(D) P-3, Q-4, R-1, S-2

26. In the context of agricultural mechanization, what is the primary operational purpose of a 'Power Tiller' in farming?
(A) Puddling operation in wetland paddy

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cultivation
(B) Deep sub-soiling up to 1 meter depth
(C) Aerial spraying of liquid fertilizers
(D) Harvesting and threshing of wheat simultaneously

27. Sprinkler irrigation is generally considered unsuitable for which type of agricultural environment?
(A) Sandy soils possessing extremely high water infiltration rates
(B) Areas experiencing continuous high-velocity winds
(C) Topography characterized by highly undulating and uneven terrain
(D) Dry regions where irrigation water availability is severely scarce

28. Consider the following statements regarding protected cultivation (polyhouse farming):
I. It allows for the cultivation of crops during their off-season.
II. It provides protection against extreme weather conditions like frost and hailstorms.
III. It relies entirely on natural rainfall for crop moisture requirements.
IV. It facilitates efficient management of pests and diseases through controlled environments.
Which of the above statements are correct?
(A) I, II and III
(B) I, II and IV
(C) II, III and IV
(D) I, III and IV

29. The Commercial Cane Sugar (CCS) percentage is an essential index used by sugar mills. Which of the following correctly describes the practical meaning of CCS?
(A) The estimated percentage of recoverable sugar from cane
(B) The total proportion of insoluble bagasse fiber remaining after complete juice extraction
(C) The cumulative percentage of cellular water content retained within harvested cane stalks
(D) The total potential yield of traditional jaggery or gur produced per hectare of crop

30. Which bio-fertilizer is most widely recommended as a soil or sett treatment in sugarcane to enhance atmospheric nitrogen fixation in the root zone?
(A) Rhizobium symbiotic nitrogen fixer
(B) Azolla pinnata aquatic bio-fertilizer
(C) Azotobacter or Gluconacetobacter
(D) Frankia actinorhizal bio-fertilizer

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31. Harvesting of sugarcane by cutting it flush with the ground (bottom cutting) is heavily emphasized in crop management. What is the primary agronomic reason for this practice?
(A) The uppermost internodes contain the highest sucrose concentration compared to lower parts
(B) It completely prevents the emergence and unwanted growth of subsequent ratoon crops
(C) It significantly simplifies manual bundle tying and field transport for farm laborers
(D) Bottom internodes have high sucrose, so low cutting prevents sugar loss

32. Consider the following field operations involved in flat-bed sugarcane planting:
1. Opening of shallow furrows at specified spacing
2. Treatment of seed setts with fungicide solution
3. Placement of setts end-to-end in the furrows
4. Preparation of a well-pulverized seedbed using tillage
Which of the following represents the correct chronological order of these operations?
(A) 4, 1, 2, 3
(B) 4, 2, 1, 3
(C) 1, 4, 2, 3
(D) 2, 4, 1, 3

33. The 'Thinning' operation in crops like mustard or sorghum is performed to achieve which specific agronomic objective?
(A) To systematically prune excess lower leaves to improve canopy air circulation and sunlight
(B) To remove excess seedlings to maintain optimum plant distance
(C) To harvest the entire biomass early prior to attaining full physiological crop maturity
(D) To mechanically decapitate the central apical shoot to promote rapid lateral branching

34. Trash mulching in a sugarcane ratoon crop is a standard agronomic practice. Which of the following is NOT a benefit of trash mulching?
(A) Conservation of essential soil moisture during critical dry summer months
(B) Effective suppression and prevention of early weed seedling emergence

(C) Continuous addition of rich organic matter to the soil upon decomposition
(D) Proliferation of early shoot borer pests under cover

35. For the mechanical harvesting of wheat, a combine harvester performs multiple operations in a single pass. Which operations are combined?
(A) Reaping, threshing, and winnowing
(B) Ploughing, sowing, and irrigation
(C) Weeding, earthing up, and fertilizer top-dressing
(D) Seed treatment, planting, and mulching

36. Consider the following statements regarding the application of fertilizers:
I. Basal application refers to the spreading or placement of fertilizer at or before the time of sowing.
II. Top-dressing is usually done with slow-release phosphatic fertilizers during the maturity phase.
III. Foliar spraying requires water-soluble fertilizers and is highly effective for micronutrient application.
Which of the above statements is/are correct?
(A) I and II only
(B) II and III only
(C) I and III only
(D) I, II and III

37. To estimate the actual crop yield potential, a farmer observes the physiological maturity of maize. What is the standard visual indicator of physiological maturity in a maize kernel?
(A) Formation of a black layer at the kernel base
(B) Complete deep greening of the outer husk wrapping the ear head
(C) Extensive longitudinal rupturing of the protective seed coat
(D) Copious exudation of thick milky sap when the kernel is pressed

38. Consider the following statements regarding the critical stages of water requirement in crops:
I. In paddy, the booting to flowering stage is highly sensitive to water stress.
II. In mustard, the pre-flowering and pod formation stages require optimal moisture.
III. In sugarcane, water stress during the ripening stage drastically increases the vegetative yield but lowers sugar recovery.
IV. In wheat, Crown Root Initiation is the most critical stage for the first irrigation.
Which of the above statements are correct?
(A) I, II and III
(B) I, II and IV
(C) II, III and IV
(D) I, III and IV

39. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): Sugarcane fields should ideally have the water supply stopped (drying off) 15 to 30 days before the scheduled harvesting date.
Reason (R): Mild soil moisture stress prior to harvesting forces the conversion of reducing sugars into sucrose and improves sugar recovery.
Select the correct answer using the options below:
(A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
(B) Both Assertion (A) and Reason (R) are true but R is not the correct explanation of A.
(C) Assertion (A) is true but Reason (R) is false.
(D) Assertion (A) is false but Reason (R) is true.

40. The 'Tying' or 'Propping' of sugarcane plants in the late grand growth stage is primarily done to:
(A) Prevent physical entry and damage by stray wild animals in the field canopy
(B) Enhance immediate nutrient uptake efficiency through accelerated root absorption
(C) Prevent lodging caused by heavy cane weight and strong winds
(D) Accelerate rapid natural drying and senescence of lower senescent leaves

41. In precision agriculture, the discharge rate of standard emitters in a drip irrigation system is typically measured in which unit?
(A) Liters per second (L/s)
(B) Cubic meters per minute (m^3/min)
(C) Gallons per day (GPD)
(D) Liters per hour (L/h)

42. Match List I with List II to choose the correct option:
List I: (Crop)
P. Paddy
Q. Potato
R. Sugarcane
S. Wheat
List II: (Recommended Sowing/Planting Method for High Yield)
1. Ridge and Furrow Method
2. Trench / Flat Bed Method

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3. Seed Drill / FIRB Method
4. Puddling and Transplanting Method

(A) P-4, Q-1, R-2, S-3
(B) P-3, Q-2, R-1, S-4
(C) P-4, Q-2, R-1, S-3
(D) P-1, Q-4, R-3, S-2

43. During the assessment of sugarcane readiness for harvest, what Brix reading on a hand refractometer is generally considered the threshold for harvest maturity?
(A) 8 to 10%
(B) 12 to 14%
(C) 18 to 20%
(D) 25 to 30%

44. Phosphorus Solubilizing Bacteria (PSB) applied as a bio-input in crop production help increase yield primarily by:
(A) Fixing atmospheric elemental nitrogen gas directly into plant-usable ammonia
(B) Solubilizing fixed soil phosphorus into plant-available forms
(C) Directly eradicating pathogenic root-knot nematodes throughout the upper soil
(D) Acting as a surface organic mulch layer to effectively preserve soil moisture

45. Consider the following statements regarding zero tillage technology:
I. It minimizes soil disturbance and preserves the natural soil structure.
II. It utilizes a specialized seed drill that cuts a narrow slit for seed placement.
III. It completely eradicates all types of perennial weeds without the need for herbicides.
IV. It leaves crop residues on the soil surface, helping in moisture conservation.
Which of the above statements are correct?
(A) I, II and III
(B) I, II and IV
(C) II, III and IV
(D) I, III and IV

46. What is the standard recommended depth of planting for sugarcane setts in the flat-bed method to ensure optimal germination and root establishment?
(A) 1 to 2 cm
(B) 5 to 10 cm
(C) 15 to 20 cm
(D) 25 to 30 cm

47. A farmer wishes to protect his nursery crop from intense solar radiation and insect vectors. Which protected cultivation structure uses specifically woven porous synthetic fabrics for this purpose?
(A) Glasshouse
(B) Poly-tunnel
(C) Naturally ventilated polyhouse
(D) Net house (Shade net)

48. In weed management, the term "Pre-emergence herbicide" refers to chemicals applied:
(A) Before the primary crop seeds are sown during preparatory field tillage
(B) When both the crop and target weeds have developed 2 to 4 true leaves
(C) After crop sowing but prior to seedling or weed emergence
(D) Immediately preceding the final physiological harvest of the mature crop

49. Which of the following sequences correctly ranks the irrigation methods from highest water application efficiency to lowest?
(A) Drip irrigation > Sprinkler irrigation > Flood irrigation
(B) Flood irrigation > Sprinkler irrigation > Drip irrigation
(C) Sprinkler irrigation > Drip irrigation > Flood irrigation
(D) Drip irrigation > Flood irrigation > Sprinkler irrigation

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50. The practice of growing two or more crops simultaneously in the same field in a definite row arrangement is scientifically termed as:
(A) Mixed cropping
(B) Relay cropping
(C) Ratoon cropping
(D) Intercropping

51. The Harvest Index (HI) of a crop is a crucial parameter in agronomy. It is calculated mathematically as the ratio of:
(A) Economic yield to Biological yield
(B) Biological yield to Economic yield
(C) Grain yield to Straw yield
(D) Fresh weight to Dry weight

52. Consider the following statements regarding the ratoon crop of sugarcane:
I. It eliminates the cost of preparatory tillage and seed material.
II. It generally matures earlier than the plant crop.

III. Ratoon stunting disease (RSD) incidence usually decreases with successive ratoons.

Which of the above statements is/are correct?
(A) I and II only
(B) II and III only
(C) I and III only
(D) I, II and III

53. Puddling in paddy cultivation is done by churning standing water and soil. What is the primary agronomic benefit of puddling?
(A) It forms a subsurface hardpan that reduces deep percolation water losses
(B) It drastically increases the overall water percolation rate and soil permeability
(C) It provides ideal aerobic soil conditions that promote vigorous weed seed germination
(D) It accelerates the rapid chemical oxidation and loss of essential soil organic matter

54. The standard seed rate for normally sown irrigated wheat is typically:
(A) 40-50 kg/ha
(B) 100-125 kg/ha
(C) 175-200 kg/ha
(D) 225-250 kg/ha

55. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): Deep placement of urea in the reduced zone of paddy soil is more beneficial than surface broadcasting.
Reason (R): Deep placement prevents the loss of nitrogen through the volatilization of ammonia and denitrification processes.
Select the correct answer using the options below:
(A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
(B) Both Assertion (A) and Reason (R) are true but R is not the correct explanation of A.
(C) Assertion (A) is true but Reason (R) is false.
(D) Assertion (A) is false but Reason (R) is true.

56. What is the primary indicator of physiological maturity in a pulse crop (like chickpea or pigeon pea) signaling that it is ready for harvesting?
(A) The plant canopy remains densely lush, highly succulent, and vivid green throughout
(B) The mature plants initiate a vigorous secondary flush of uniform floral blooms
(C) Pods turn brown, dry up, and seeds harden at low moisture
(D) The lower canopy leaves multiply rapidly while increasing photosynthetic output

57. Which biological input is specifically utilized as a bio-control agent to manage soil-borne fungal diseases like wilt in crops?
(A) Bacillus thuringiensis (Bt)
(B) Beauveria bassiana
(C) Nuclear Polyhedrosis Virus (NPV)
(D) Trichoderma viride

58. Match List I with List II to choose the correct option:
List I: (Sugarcane Disease/Pest)
P. Red Rot
Q. Early Shoot Borer
R. Pyrilla
S. Smut
List II: (Distinct Symptom/Damage)
1. Dead heart that pulls out easily and emits a foul smell
2. Sucking cell sap and excreting honeydew leading to sooty mold
3. Production of a black whip-like structure from the central growing point
4. Sour/alcoholic smell from split canes with reddened internal tissues
(A) P-4, Q-1, R-2, S-3
(B) P-1, Q-4, R-3, S-2
(C) P-4, Q-2, R-1, S-3
(D) P-3, Q-1, R-4, S-2

59. Which of the following is an accurate definition of the term "Water Use Efficiency" (WUE) in agricultural production?
(A) The mathematical ratio comparing total irrigation applied to total seasonal rainfall received
(B) Marketable yield produced per unit of water lost to evapotranspiration
(C) The instantaneous physical rate at which applied water infiltrates down the soil surface profile
(D) The cumulative percentage of gross irrigation water retained behind major dams and reservoirs

60. The planting of autumn sugarcane is optimally carried out during which specific time window?
(A) Mid-February through Mid-March period
(B) Mid-April through Mid-May summer phase
(C) Mid-September to Mid-November
(D) Mid-December through Mid-January window

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61. For effective control of the parasitic weed 'Striga', which is a major problem in sugarcane and sorghum, farmers must primarily focus on:
(A) Using weed-free seeds and rotating with non-host trap crops
(B) Continuous deep waterlogging of the agricultural field for three consecutive summer months
(C) Applying exclusively high doses of nitrogenous fertilizers while omitting phosphorus inputs
(D) Releasing high populations of predatory bio-control insects such as Ladybird beetles

62. Consider the following statements regarding the determination of fertilizer quantities:
I. The requirement depends strictly on soil test values and the target yield of the crop.
II. Organic manures and chemical fertilizers cannot be used in conjunction.
III. Varieties with higher yield potential generally require higher fertilizer doses.
Which of the above statements is/are correct?
(A) I and II only
(B) II and III only
(C) I and III only
(D) I, II and III

63. To supply exactly 46 kg of elemental Nitrogen to a crop field, approximately how much agricultural-grade Urea (46% N) must a farmer apply?
(A) 46 kg
(B) 100 kg
(C) 150 kg
(D) 200 kg

64. The phenomenon of "Transplanting shock" in paddy refers to:
(A) Severe sudden wilting observed in mature crop canopies prior to harvest under acute heat stress
(B) Widespread physical damage inflicted on young nursery seedlings by unexpected torrential rainfall
(C) Temporary growth check and root injury when transplanting seedlings
(D) Foliar chemical burning and necrosis induced by applying high concentrations of weedkillers

65. The critical weed-free period for most field crops, during which weeding must be done to prevent significant yield losses, generally falls within:
(A) The final ten days immediately prior to crop physiological harvesting
(B) The early growth phase, typically 15 to 45 days after sowing
(C) The late peak maturity and grain ripening phase of plant growth
(D) The uncropped post-harvest fallow period following main harvest

66. In soil moisture conservation practices, what is the primary function of constructing 'contour bunds' on sloping agricultural land?
(A) To deliberately increase the flow velocity of surface water runoff across slopes
(B) To excavate deep earth trenches specifically for burying post-harvest crop residues
(C) To permanently mark physical property boundaries between different crop varieties
(D) To retard runoff water, enhance soil infiltration, and curb erosion

67. Which of the following indicators suggests that sugarcane is NOT yet ready for optimal harvest and is still immature?
(A) High proportion of reducing sugars in cane juice
(B) A uniform Brix reading ratio between upper and lower stalk internodes approaching 1.0
(C) Complete natural cessation of active vegetative shoot growth and leaf initiation
(D) A distinct metallic ringing sound produced when striking the mature stalk with fingers

68. Consider the following statements regarding agricultural land levelling:
I. Laser land levelling ensures precise and uniform distribution of irrigation water.
II. Proper land levelling reduces weed problems by eliminating low-lying waterlogged patches.
III. Levelling drastically increases the labor required for crop harvesting.
Which of the above statements is/are correct?
(A) I and II only
(B) II and III only
(C) I and III only
(D) I, II and III

69. For calculating the exact seed requirement of a crop, which two primary parameters must an agronomist absolutely know?
(A) Seed test weight and target plant population per hectare
(B) Total annual regional rainfall distribution and seasonal prevailing wind speed patterns

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(C) The specific commercial brand of seed drill and tractor engine horsepower rating
(D) The market acquisition cost per kilogram of seed and associated field transport charges

70. What is the standard scientific method to minimize the transmission of seed-borne diseases before sowing any crop?
(A) Thoroughly washing harvested seed lots with clean running tap water prior to planting
(B) Exposing stored seeds directly to open intense solar radiation for a full month
(C) Mixing seed lots with granular urea fertilizer immediately before field sowing
(D) Seed dressing with appropriate fungicides or bio-agents

71. Consider the following statements regarding inter-cultivation tools used in agriculture:
I. A wheel hoe is primarily operated manually for weeding in row crops.
II. A sweep cultivator is used to cut weed roots below the soil surface without inverting the soil.
III. A disc plough is considered an inter-cultivation tool for standing mature sugarcane.
IV. Earthing up attachments (ridgers) can be mounted on tractor-drawn cultivators.
Which of the above statements are correct?
(A) I, II and III
(B) I, II and IV
(C) II, III and IV
(D) I, III and IV

72. Sugarcane setts are traditionally prepared using which specific section of the mature cane stalks to ensure the highest germination percentage?
(A) The bottom one-third stalk portion
(B) Only the central middle internodes
(C) The top portion of the stalk
(D) The dried leaves and leaf sheaths

73. When practicing crop rotation, a deep-rooted crop should ideally be followed by a shallow-rooted crop. What is the fundamental agronomic reason for this practice?
(A) To prevent physical wear and accidental damage to heavy tractor tillage implements
(B) To maintain an identical microclimate canopy condition right at the soil surface
(C) To concentrate soluble soil salinity strictly within the shallow crop root zone
(D) To extract nutrients and moisture from varied soil depths

74. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): Sugarcane is designated as a heavy feeder crop and requires substantial amounts of N, P, and K.
Reason (R): It produces a massive quantity of biomass (80-100 tonnes/ha) over a long duration, thereby extracting large amounts of nutrients from the soil.
Select the correct answer using the options below:
(A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
(B) Both Assertion (A) and Reason (R) are true but R is not the correct explanation of A.
(C) Assertion (A) is true but Reason (R) is false.
(D) Assertion (A) is false but Reason (R) is true.

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75. Which innovative irrigation technology uses buried perforated pipes to deliver water directly to the plant root zone, effectively minimizing surface evaporation to near zero?
(A) Automated surge flow irrigation
(B) Sub-surface drip irrigation (SDI)
(C) Center pivot overhead sprinkler system
(D) Border strip surface flooding method

76. In an un-levelled field with minor undulations, which form of surface irrigation is most prone to causing waterlogging in depressions and moisture stress on elevations?
(A) Micro-drip irrigation system
(B) Uncontrolled free flooding
(C) Corrugation surface irrigation
(D) Raised ridge furrow irrigation

77. The recommended depth of intercultural hoeing in an established crop field should generally be:
(A) Shallow (2-5 cm) to disrupt weeds and crusts without harming roots
(B) Very deep (exceeding 30 cm) to completely invert and bring up hard subsoil layers
(C) Maintained exactly equal to the full operating depth of primary mouldboard ploughing
(D) Executed deep enough to thoroughly uproot and remove the standing main crop canopy

78. Which sequence correctly orders the common stages of an integrated weed management (IWM) program in crop production?
(A) Chemical spray, Sowing, Hand weeding

(B) Stale seedbed preparation, Sowing, Pre-emergence herbicide, Inter-cultivation
(C) Harvesting, Pre-emergence herbicide, Sowing, Post-emergence herbicide
(D) Inter-cultivation, Sowing, Pre-emergence herbicide, Deep ploughing

79. When manually calculating the correct quantity of chemical fertilizer to be applied per hectare, an agronomist divides the recommended dose of the nutrient by:
(A) The retail market price per bag of the commercial fertilizer formulation
(B) The total geographic area of the farm unit multiplied by crop seed rate
(C) The total number of days required for the crop to reach maturity
(D) Percent nutrient content in the fertilizer, multiplying by 100

80. Identify the modern agricultural bio-input that specifically forms a symbiotic association with crop roots, greatly expanding their network to improve water and immobile nutrient (especially phosphorus) absorption.
(A) Deep-placed urea super granules
(B) Granular phorate 10G systemic insecticide
(C) Vesicular Arbuscular Mycorrhiza (VAM)
(D) Copper oxychloride broad-spectrum fungicide

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ANSWERS

1. (B) To expose soil-borne pests, pathogens, and weed seeds to intense solar radiation
Deep summer ploughing involves turning over the soil during peak summer months before monsoon rains begin. This agronomic practice exposes dormant weed seeds, harmful insect pupae, soil-borne fungi, and pathogenic organisms present in lower soil layers to intense solar radiation and high ambient temperatures, effectively sterilizing the seedbed naturally and enhancing soil water intake capacity.

2. (D) After planting but before the emergence of the sugarcane sprouts
Blind hoeing is an essential intercultural operation in sugarcane cultivation performed after planting setts but prior to shoot emergence. Since sugarcane germination takes three to four weeks, weeds germinate rapidly following early irrigations. Shallow hoeing breaks the hard surface crust, suppresses early weed growth, improves soil aeration, and facilitates unobstructed emergence of young sprouts.

3. (C) 83,333 plants
Plant population per hectare is calculated by dividing total area in square meters by individual plant area. One hectare equals ten thousand square meters. Converting row spacing of zero point six meters and plant spacing of zero point two meters yields zero point one two square meters per plant. Dividing ten thousand by zero point one two gives approximately eighty-three thousand three hundred thirty-three plants.

4. (A) I and II only
The trench method of sugarcane planting involves digging deep trenches of twenty to thirty centimeters. It provides excellent root anchorage, preventing lodging in tall, heavy crops, while reducing irrigation water requirements by concentrating water directly in trenches. Shallow trenching is incorrect because deep trenches are required. Therefore, only statements regarding lodging protection and water efficiency are accurate.

5. (A) It reduces seed and water requirements while sustaining crop yields.
The System of Rice Intensification is an innovative methodology that utilizes significantly young single seedlings transplanted with wider spacing in unflooded soils. This approach drastically lowers seed rate and water consumption while encouraging robust root systems and higher tiller production, ultimately maintaining or improving overall yield without continuous standing water requirements associated with conventional transplanting.

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6. (D) Carbendazim or organomercurial fungicides
Sugarcane setts are highly vulnerable to major soil-borne fungal pathogens such as red rot and smut during early germination. Pre-planting fungicidal seed treatment using systematic compounds like carbendazim or organomercurials protects setts, prevents fungal spore entry through cut ends, improves sprout emergence percentage, and ensures uniform crop establishment in field conditions.

7. (A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
Cereal crops exhibit varying nitrogen demands across different physiological growth phases. Applying the total nitrogen fertilizer as a single basal dose leads to excessive leaching, denitrification, and volatilization losses. Splitting nitrogen applications aligns nutrient supply directly with plant intake stages, significantly minimizing environmental losses and maximizing fertilizer efficiency throughout the vegetative and reproductive development cycles.

8. (C) Crown Root Initiation (CRI) stage
Crown Root Initiation is the most critical irrigation stage in wheat development, occurring roughly twenty-one days after sowing. During this phase, crown roots initiate below the soil surface to support overall tillering and plant structure. Water deficit during Crown Root Initiation causes permanent tiller reduction and poor spikelet development, leading to severe grain yield loss.

9. (D) P-4, Q-3, R-2, S-1
Mechanical weed control includes physical operations like running cultivators or hoes. Cultural weed control involves farming practices like crop rotation and intercropping to alter growth conditions. Chemical weed control utilizes herbicides such as pendimethalin for suppression. Biological control utilizes living agents, exemplified by using Zygogramma bicolorata beetles to consume and suppress invasive Parthenium weeds.

10. (A) Companion cropping
Companion cropping is an advanced intercropping system where two crops are grown together, and the companion crop provides ecological or physical benefits such as pest trapping, shade, or structural support without competing with the primary crop for light, nutrients, or water. This synergistic arrangement enhances overall yield stability and optimizes localized resource utilization within the field canopy.

11. (B) Hand Refractometer
A hand refractometer is a portable optical instrument used directly in agricultural fields to evaluate crop maturity. It measures the refractive index of cane juice to determine the total soluble solids percentage, commonly known as the Brix value. This quick field assessment enables precise determination of peak sucrose concentration for scheduling optimal harvest operations.

12. (C) IV only
The ring pit method involves excavating circular pits where setts are planted in a radial layout, enabling high plant density and superior cane yields. However, this method is unsuitable for waterlogged regions because circular pits trap excess water, leading to sett rot and root hypoxia. Consequently, claiming suitability for waterlogged areas is incorrect regarding this technique.

13. (C) 100-120 days after planting
Earthing up is an essential intercultural operation in sugarcane cultivation where soil is mounded around the base of stalks. The major earthing up operation is typically executed around one hundred to one hundred twenty days post-planting during peak tillering. This action suppresses late tillers, strengthens root anchoring, forms deep drainage furrows, and effectively prevents lodging.

14. (B) 35,000 to 40,000 setts
Under conventional flat-bed sugarcane planting, the recommended seed requirement is approximately thirty-five thousand to forty thousand three-budded setts per hectare. This quantity ensures an adequate density of viable buds, achieving uniform germination and optimal initial stalk counts across field rows, compensating for potential field losses and non-germinating buds under standard agricultural conditions.

15. (D) Germination phase, Formative phase, Grand growth phase, Maturity phase
Sugarcane development follows four sequential physiological stages. The germination phase occurs first as buds sprout. The formative phase follows, characterized by shoot emergence and rapid tillering. Next, the grand growth phase involves rapid stalk elongation and biomass accumulation. Finally, the maturity phase occurs, during which vegetative growth ceases and sucrose accumulates within mature stalk internodes.

16. (C) Seed drill sowing
Sowing with a seed drill provides mechanical precision by dropping seeds at controlled depths and uniform row spacings. Unlike broadcasting, which results in irregular seed distribution and exposed seeds, seed drilling places seeds in moist soil furrows, ensuring consistent seed-to-soil contact, optimal moisture absorption, synchronized emergence, and effective early weed management between rows.

17. (B) Conserving soil moisture and suppressing weed emergence
Applying organic mulch over soil surfaces creates a physical barrier that minimizes direct solar radiation exposure and wind contact. This protective layer drastically reduces surface water evaporation, maintains cooler soil temperatures, and blocks sunlight from reaching weed seeds, thereby inhibiting weed germination while preserving critical root-zone moisture necessary for optimal crop development.

18. (D) Spaced Transplanting (STP) Method
The Spaced Transplanting method involves raising single-budded sugarcane setts in nurseries or pro-trays using polythene bags before transplanting healthy seedlings into main production fields. This nursery technique

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drastically lowers required seed stalk volume, overcomes field germination issues, ensures uniform plant establishment, facilitates wider row spacing, and enhances tiller production per unit land area.

19. (A) I and II only
Drip irrigation precise application delivers water directly to the root zone, significantly reducing weed proliferation between non-irrigated row spaces. Contrary to the claim about fertigation, drip systems excel at delivering liquid water-soluble fertilizers directly into root zones. Therefore, statements emphasizing localized root delivery and weed reduction are accurate, whereas the fertigation exclusion statement is false.

20. (C) Broadleaf weeds and annual grasses
Atrazine is a selective triazine pre-emergence herbicide widely applied in sugarcane and maize crops. It acts primarily by inhibiting photosynthesis in target plants. Applied shortly after crop sowing, Atrazine effectively controls a broad spectrum of emerging annual grass weeds and broadleaf weed species, allowing the main crop to establish without competitive pressure.

21. (A) Formative phase
The formative phase in sugarcane occurs from sixty to one hundred twenty days post-planting and represents the critical stage for tiller development and leaf canopy construction. Soil moisture deficits during this formative stage drastically impair tillering potential, reduce final stalk density, and impair stalk elongation, ultimately causing severe and permanent reductions in yield.

22. (A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
Autumn-planted sugarcane generally achieves higher yields than spring-planted cane because it gains a head start of several months before winter. This extended growth duration enables robust root system establishment and enhanced tillering in spring, allowing the crop to fully capitalize on favorable pre-monsoon and monsoon climatic conditions for maximum biomass production.

23. (B) Mutual shading occurs, causing weak stems and high lodging risk
Exceeding optimal plant population density leads to intense intra-specific competition for available sunlight, water, and soil nutrients. Mutual shading among dense foliage reduces net photosynthetic efficiency and promotes stem elongation at the expense of stem thickness. These etiology symptoms produce thin, weak stalks that are highly susceptible to severe lodging under wind or rain.

24. (C) Potato
Autumn sugarcane provides wide inter-row spacing and slow early growth during initial months. Intercropping with short-duration crops like potato optimizes land utilization during winter without competing aggressively with the slow-growing cane setts. This practice generates early farm income, improves soil cover, reduces weed emergence, and yields high net economic returns per unit area.

25. (D) P-3, Q-4, R-1, S-2
Mouldboard ploughs perform soil inversion in primary tillage. Rotavators pulverize soil while incorporating organic residues in a single operation. Disc harrows crush heavy clods during secondary seedbed preparation. Seed-cum-fertilizer drills simultaneously deposit seeds and fertilizers at precise soil depths and uniform row spacings for uniform crop germination.

26. (A) Puddling operation in wetland paddy cultivation
Power tillers are versatile walk-behind agricultural machines equipped with rotary tillers, specifically engineered for operating in small or muddy fields. Their light weight and high maneuverability make them exceptionally suitable for performing puddling operations in flooded paddy fields, churning soil to create an impermeable hardpan while destroying weeds prior to transplanting.

27. (B) Areas experiencing continuous high-velocity winds
Sprinkler irrigation sprays pressurized water through nozzles into the air to mimic natural rainfall. In regions subject to continuous high-velocity winds, wind drift severely distorts spray patterns, causing uneven water distribution, excessive evaporative losses before reaching the ground, and inadequate moisture delivery to targeted crop roots, making this system inefficient under windy conditions.

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28. (B) I, II and IV
Polyhouse farming establishes a controlled microclimate that enables off-season crop production, shields plants from extreme frost or hail, and manages pest infestations through physical barriers. It does not rely on natural rainfall because irrigation is managed internally using micro-irrigation systems. Thus, statements regarding off-season production, weather protection, and pest control are accurate.

29. (A) The estimated percentage of recoverable sugar from cane
Commercial Cane Sugar percentage represents the calculated quantity of pure sucrose that can be commercially extracted from harvested sugarcane during factory milling operations. It accounts for juice extraction, total soluble solids, and sucrose purity. This measurement determines the actual industrial sugar recovery rate and serves as the baseline for evaluating sugarcane crop quality.

30. (C) Azotobacter or Gluconacetobacter
Gluconacetobacter diazotrophicus and Azotobacter are non-symbiotic or endophytic nitrogen-fixing bacteria widely applied as bio-fertilizers in sugarcane. They colonize internal plant tissues and rhizosphere zones, converting atmospheric nitrogen gas into ammonium forms accessible by the plant. This biological activity enhances root expansion, promotes shoot growth, and reduces synthetic nitrogen fertilizer application rates.

31. (D) Bottom internodes have high sucrose, so low cutting prevents sugar loss
Sugarcane accumulates the highest concentration of sucrose in its lower mature stalk internodes near ground level. Harvesting flush with the soil ensures the extraction of these sugar-rich basal segments, maximizing tonnage and sugar recovery. Leaving elevated stubble results in severe economic yield losses and hinders proper ratoon crop emergence from sub-surface buds.

32. (A) 4, 1, 2, 3
Flat-bed sugarcane planting follows a systematic sequence. First, field tillage creates a fine seedbed. Next, shallow furrows are opened at recommended spacings. Seed setts are subsequently treated with fungicide solution to protect cut ends from soil pathogens. Finally, treated setts are placed end-to-end within furrows and covered with a soil layer.

33. (B) To remove excess seedlings to maintain optimum plant distance
Thinning is a vital intercultural practice carried out during early crop establishment stages. It involves manually pulling out crowded, excess, weak, or diseased seedlings from densely sown rows. This operation establishes recommended plant-to-plant spacing, eliminates extreme intra-crop competition for light, moisture, and nutrients, and fosters robust individual plant development.

34. (D) Proliferation of early shoot borer pests under cover
Trash mulching in sugarcane ratoons provides substantial agronomic benefits, including moisture conservation, weed suppression, and soil organic matter enrichment upon decay. The claim regarding early shoot borer proliferation is incorrect; trash mulching actually reduces early shoot borer infestations by physically obstructing adult moth egg-laying activities and altering soil surface microclimate.

35. (A) Reaping, threshing, and winnowing
A combine harvester is a multi-functional agricultural machine engineered to streamline grain harvesting. In a continuous operation across the field, it performs cutting standing crops (reaping), separating grain kernels from ears or pods (threshing), and blowing away lighter chaff and debris (winnowing), delivering clean grain into holding tanks while depositing straw residues behind.

36. (C) I and III only
Basal application involves applying fertilizers into soil during seedbed preparation or sowing. Foliar application utilizes water-soluble compounds sprayed directly onto foliage for rapid micronutrient uptake. Top-dressing with slow-release phosphatic fertilizers during maturity is incorrect, as phosphatic inputs are applied basally and nitrogen is top-dressed. Thus, only statements on basal and foliar methods are correct.

37. (A) Formation of a black layer at the kernel base
Physiological maturity in maize is definitively indicated by the appearance of a dark abscission layer, known as the black layer, at the tip base

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where the kernel attaches to the cob. This layer signifies that assimilate translocation into the grain has completely ceased, maximum dry weight accumulation is achieved, and moisture loss will follow.

38. (B) I, II and IV
Paddy requires adequate water from booting to flowering stages, mustard is sensitive during pre-flowering and pod filling, and wheat demands moisture at Crown Root Initiation. Water stress during sugarcane ripening increases sucrose accumulation rather than lowering sugar recovery. Consequently, statements regarding paddy, mustard, and wheat are accurate, while the sugarcane statement is incorrect.

39. (A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
Withholding irrigation weeks before harvesting sugarcane induces mild moisture stress within the plant. This stress halts vegetative growth and leaf production, forcing the crop to convert reducing sugars into sucrose for storage in stalk internodes. Consequently, drying off sugarcane fields enhances sucrose concentration and significantly improves factory sugar recovery percentages.

40. (C) Prevent lodging caused by heavy cane weight and strong winds
Propping or tying sugarcane involves bundling standing stalks together using their own lower senescent leaves during the late grand growth phase. Tall, high-yielding sugarcane crops become heavy and vulnerable to uprooting or stem breakage from strong monsoon winds. Tying stabilizes the crop canopy, prevents lodging losses, and preserves stalk quality.

41. (D) Liters per hour (L/h)
Drip irrigation delivers precise volumes of water directly to plant root zones through micro-emitters attached to lateral pipelines. Because emitter output is designed for slow, continuous application to match soil infiltration without surface runoff, discharge rates are standardized and measured in liters per hour, typically ranging from one to eight liters per hour.

42. (A) P-4, Q-1, R-2, S-3
Paddy achieves optimal yields when grown using puddling and transplanting techniques. Potato requires ridge and furrow planting to support tuber expansion. Sugarcane utilizes deep trench or flat-bed systems for strong stalk anchorage. Wheat is efficiently sown using seed drills or Furrow Irrigated Raised Bed systems to optimize plant distribution and water management.

43. (C) 18 to 20%
Hand refractometers measure the percentage of total soluble solids, or Brix value, in standing sugarcane juice. A uniform Brix reading between eighteen and twenty percent across the top, middle, and bottom stalk sections indicates full sucrose accumulation and peak physiological crop maturity, serving as the threshold for scheduling commercial harvest.

44. (B) Solubilizing fixed soil phosphorus into plant-available forms
Phosphorus Solubilizing Bacteria are beneficial soil microorganisms that secrete organic acids and enzymes. These substances solubilize insoluble inorganic and organic phosphorus compounds bound to soil minerals, converting them into orthophosphate ions. This bio-conversion increases phosphorus availability in the root zone, enhancing root development, plant strength, and crop yield.

45. (B) I, II and IV
Zero tillage preserves soil structure by eliminating primary tillage, uses specialized zero-till drills to place seeds in narrow slits, and leaves organic surface residues to conserve moisture. It does not eliminate perennial weeds without chemical intervention, as herbicides are needed for weed suppression. Therefore, statements on soil preservation, specialized drills, and residue conservation are correct.

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46. (B) 5 to 10 cm
In flat-bed sugarcane planting, setts are placed at a depth of five to ten centimeters. This depth provides adequate coverage to protect buds from direct heat and desiccation, while placing them in moist soil to stimulate fast germination and root development. Deeper planting delays emergence, whereas shallower planting risks drying out.

47. (D) Net house (Shade net)
A net house is an agricultural structure enclosed with porous woven synthetic monofilament nets. It modulates light intensity, lowers ambient heat stress, and forms a physical barrier against insect vectors such as whiteflies and aphids. This

controlled microclimate protects tender nursery seedlings and high-value horticultural crops from physical damage and viral infections.

48. (C) After crop sowing but prior to seedling or weed emergence
Pre-emergence herbicides are chemical formulations applied to the soil surface following crop seed placement but before target weeds or crop seedlings germinate and break through the soil surface. They establish a toxic barrier in the upper soil layer, destroying germinating weed seeds upon sprout contact and ensuring weed-free initial growth.

49. (A) Drip irrigation > Sprinkler irrigation > Flood irrigation
Drip irrigation achieves the highest water application efficiency by delivering water directly to root zones with minimal evaporation. Sprinkler irrigation offers intermediate efficiency by spraying water over crop canopies, incurring minor wind drift and evaporation losses. Surface flood irrigation exhibits the lowest efficiency due to significant surface runoff, deep percolation, and high soil evaporation.

50. (D) Intercropping
Intercropping is the practice of growing two or more distinct crop species concurrently within the same field following a defined geometric row pattern. This spatial arrangement maximizes canopy light interception, optimizes root distribution across soil profiles, reduces weed competition, and mitigates yield risks compared to monocropping or unstructured mixed cropping systems.

51. (A) Economic yield to Biological yield
Harvest Index quantifies the physiological efficiency of a crop in converting total synthesized dry matter into economically valuable components. Mathematically, it is expressed as the ratio of economic yield, such as harvested grains or roots, to total biological yield, which encompasses all above-ground vegetative biomass and grain weight produced per unit area.

52. (A) I and II only
Ratoon sugarcane crops eliminate initial land preparation costs and purchasing seed setts, while maturing earlier than planted crops due to pre-established root networks. The claim that ratoon stunting disease decreases with successive ratoons is false, as viral and bacterial pathogens accumulate over cycles. Thus, statements regarding cost reduction and early maturity are accurate.

53. (A) It forms a subsurface hardpan that reduces deep percolation water losses
Puddling involves mechanically tilling flooded paddy soil to break down aggregates and align clay particles. This process forms a dense, impervious subsurface hardpan that drastically reduces water percolation losses. Additionally, puddling suppresses weed growth, improves nutrient availability, and creates a soft mud layer that facilitates rapid transplanting of young rice seedlings.

54. (B) 100-120 kg/ha
For irrigated wheat under normal sowing schedules, the standard recommended seed rate is one hundred to one hundred twenty kilograms per hectare. This seeding density ensures optimal plant population per square meter, compensating for field germination percentages, and allows optimal tillering to form a dense crop canopy capable of achieving potential grain yields.

55. (A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
Deep placement of urea fertilizer into the reduced root zone of flooded paddy soils prevents ammonium ions from converting into nitrate ions. In contrast, surface-applied nitrogen undergoes rapid nitrification-denitrification cycles and ammonia volatilization in oxidized water layers. Subsurface placement keeps nitrogen stable, ensuring continuous uptake and significantly enhancing fertilizer nitrogen use efficiency.

56. (C) Pods turn brown, dry up, and seeds harden at low moisture
Physiological maturity in pulse crops is clearly indicated when the vegetative foliage turns yellow and senesces, while pods turn brown, dry out, and harden. At this stage, nutrient translocation into seeds ceases, seed moisture drops significantly, and crops reach peak dry weight, signaling the proper harvest window to avoid pod shattering.

57. (D) Trichoderma viride
Trichoderma viride is a beneficial soil fungus widely utilized as a biological seed and soil treatment agent. It controls soil-borne fungal

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pathogens that cause wilt, root rot, and damping-off through mechanisms including mycoparasitism, antibiosis, and competition for space and nutrients, promoting root growth without reliance on synthetic chemical fungicides.

58. (A) P-4, Q-1, R-2, S-3
Sugarcane red rot causes reddened internal stalk tissues emitting an alcoholic odor. Early shoot borer attacks create dead hearts that pull out easily with foul odors. Pyrilla bugs suck cell sap while excreting honeydew that fosters dark sooty mold on leaves. Smut infection produces a distinct black, whip-like fungal structure from central growing tips.

59. (B) Marketable yield produced per unit of water lost to evapotranspiration
Water Use Efficiency measures an agricultural system's capacity to convert available water into harvested biomass. Quantitatively, it represents the ratio of marketable crop economic yield to total volume of water lost through plant transpiration and soil surface evaporation. Higher efficiency values indicate superior crop productivity per unit of water consumed.

60. (C) Mid-September to Mid-November
Autumn sugarcane planting is carried out from mid-September to mid-November across major growing belts. Planting during this autumnal window allows setts to germinate and establish strong root systems before severe winter temperatures arrive. The crop resumes rapid vegetative growth in early spring, yielding higher biomass than spring-planted sugarcane crops.

61. (A) Using weed-free seeds and rotating with non-host trap crops
Striga is a parasitic weed that attaches directly to host roots, severely depleting nutrients and water. Managing Striga requires integrating cultural operations, including planting clean, weed-free seed lots and implementing crop rotations with non-host trap crops like cotton or sunflower. These trap crops stimulate Striga seed germination without providing a viable host, depleting soil seed banks.

62. (C) I and III only
Fertilizer requirements are determined using soil testing, yield goals, and crop variety responses, as high-yielding cultivars require increased nutrient inputs. The claim that organic manures and chemical fertilizers cannot be used together is incorrect, as Integrated Nutrient Management combines both sources. Consequently, statements regarding soil test target yields and varietal demands are correct.

63. (B) 100 kg
Agricultural-grade urea contains forty-six percent elemental nitrogen by weight, meaning one hundred kilograms of urea provides forty-six kilograms of nitrogen. To calculate urea requirement, divide target nitrogen mass by nutrient percentage and multiply by one hundred. Applying one hundred kilograms of urea supplies forty-six kilograms of nitrogen to the soil.

64. (C) Temporary growth check and root injury when transplanting seedlings
Transplanting shock describes the temporary physiological retardation and wilting experienced by young rice seedlings upon removal from nursery beds and root placement into flooded main fields. This setback results from minor root damage, altered environmental conditions, and water absorption delays, requiring several days for seedlings to re-establish root structures and resume growth.

65. (B) The early growth phase, typically 15 to 45 days after sowing
The critical weed-free period represents the essential window during crop development when weed competition causes severe yield reduction. For most field crops, this period occurs early in growth, generally fifteen to forty-five days after sowing. Maintaining weed-free fields during this timeframe prevents resource competition and protects potential final yields.

66. (D) To retard runoff water, enhance soil infiltration, and curb erosion
Contour bunding involves constructing mechanical earthen ridges across sloping farm fields along equal elevation lines. These bunds intercept surface runoff, reduce water flow velocity, prevent soil erosion, and hold water behind structures. This extended detention increases soil moisture infiltration, replenishes subsoil moisture reserves, and protects fertile topsoil on sloping agricultural lands.

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67. (A) High proportion of reducing sugars in cane juice
Immature sugarcane stalks contain elevated concentrations of simple reducing sugars like glucose and fructose, which have not yet synthesized into complex sucrose molecules. As sugarcane reaches full maturity, these reducing sugars convert into sucrose. A high proportion of reducing sugars indicates immature cane, unready for optimal harvesting and processing.

68. (A) I and II only
Laser land levelling establishes a smooth, even soil surface, ensuring uniform water distribution and eliminating waterlogged depressions where weeds thrive. The claim that levelling increases harvesting labor is false, as smooth field surfaces improve machinery efficiency and lower manual labor requirements. Thus, statements regarding water distribution and weed reduction are accurate.

69. (A) Seed test weight and target plant population per hectare
Calculating exact seeding rates requires knowing target plant population per hectare and individual seed test weight, such as thousand-grain mass. Incorporating real field germination percentages and seed purity parameters into this calculation allows agronomists to determine the exact weight of seed needed to establish optimal crop stands per land area.

70. (D) Seed dressing with appropriate fungicides or bio-agents
Seed dressing with systemic or contact fungicides or beneficial bio-agents is the standard preventive practice to control seed-borne and early soil-borne diseases. Treating seed surfaces creates a protective chemical or biological barrier around germinating seeds, suppressing fungal spores, preventing damping-off, and ensuring healthy seedling establishment and field stands.

71. (B) I, II and IV
Wheel hoes enable manual weeding in row crops, sweep cultivators sever weed roots without soil inversion, and tractor-drawn ridgers perform mechanical earthing up. Describing a disc plough as an inter-cultivation tool in standing sugarcane is incorrect, as primary disc ploughing damages crop roots. Thus, statements on wheel hoes, sweeps, and ridgers are correct.

72. (C) The top portion of the stalk
The upper third portion of mature sugarcane stalks provides superior seed sett material for planting. These top segments contain younger, highly active buds with rich nitrogenous reserves and elevated water content. Consequently, setts prepared from top sections exhibit higher germination percentages, rapid sprout emergence, and vigorous initial shoot establishment compared to basal stalk portions.

73. (D) To extract nutrients and moisture from varied soil depths
Alternating deep-rooted crops with shallow-rooted crops in crop rotations optimizes subsoil resource utilization. Deep-rooted plants extract water and nutrients from deeper soil layers, drawing up immobilized minerals. Subsequent shallow-rooted plants absorb nutrients from upper soil profiles. This practice balances soil nutrient extraction, prevents hardpan development, and improves overall soil structure.

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74. (A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
Sugarcane is classified as a heavy nutrient feeder because it remains in the field for twelve to eighteen months, producing large biomass yields of eighty to one hundred tonnes per hectare. This massive vegetative production extracts substantial quantities of nitrogen, phosphorus, and potassium from soils, requiring high fertilizer applications to maintain soil fertility.

75. (B) Sub-surface drip irrigation (SDI)
Sub-surface drip irrigation utilizes permanently buried drip tubes equipped with micro-emitters located beneath the soil surface within root zones. This targeted design applies water directly to active roots without wetting soil surfaces, virtually eliminating evaporative losses, preventing surface crusting, suppressing weed germination, and delivering high water application efficiency for field crops.

76. (B) Uncontrolled free flooding
Uncontrolled free flooding on uneven land causes irregular water distribution across the field. Water accumulates in natural low-lying depressions, creating localized waterlogging and root asphyxiation, while elevated field areas remain under-irrigated and suffer moisture stress. This uneven moisture profile leads to non-

uniform crop growth, poor fertilizer uptake, and yield loss.

77. (A) Shallow (2-5 cm) to disrupt weeds and crusts without harming roots
Intercultural hoeing in established crop fields should be kept shallow, between two and five centimeters depth. Shallow tillage effectively severs emerging weed roots, breaks surface crusts, and improves soil aeration and moisture retention. Deep hoeing damages lateral crop root systems, disrupts growth, and brings deeply buried weed seeds to surface layers.

78. (B) Stale seedbed preparation, Sowing, Pre-emergence herbicide, Inter-cultivation
Integrated weed management follows a logical chronological sequence. Preparing a stale seedbed encourages early weed seed germination for removal before sowing main crops. Following sowing, applying a pre-emergence herbicide creates a chemical weed barrier. Subsequent mechanical inter-cultivation or hand weeding suppresses late-emerging weeds, ensuring season-long weed control without relying exclusively on herbicides.

79. (D) Percent nutrient content in the fertilizer, multiplying by 100
To calculate the commercial fertilizer required to deliver a target nutrient dosage per hectare, divide recommended nutrient mass by active ingredient percentage in the fertilizer formulation, then multiply by one hundred. This mathematical formula converts pure nutrient recommendations into actual commercial fertilizer product mass needed for field application.

80. (C) Vesicular Arbuscular Mycorrhiza (VAM)
Vesicular Arbuscular Mycorrhiza is a beneficial soil fungus that forms a symbiotic association with plant roots. Hyphal networks extend beyond root zones into fine soil pores, dramatically expanding root absorption surface area. This symbiosis enhances host plant uptake of immobile soil nutrients, particularly phosphorus and trace minerals, improving plant drought tolerance.

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CHAPTER 03

Post-Harvest Management and Processing

1. What is the primary objective of post-harvest management in agricultural crops?
(A) To increase the crop yield per hectare in the field
(B) To minimize quantitative and qualitative losses after harvesting
(C) To enhance the genetic potential of the seed for the next season
(D) To reduce the requirement of irrigation during the crop growth period

2. Which of the following operations is classified as secondary processing of agricultural produce?
(A) Cleaning of wheat grains
(B) Grading of apples based on size
(C) Drying of harvested paddy
(D) Milling of wheat into wheat flour (maida)

3. Given below are two statements, one labeled as Assertion (A) and the other as Reason (R):
Assertion (A): Mechanized harvesting using combine harvesters reduces the time of harvest but often leaves crop residue in the field.
Reason (R): Combine harvesters perform cutting, threshing, and cleaning simultaneously but do not automatically bundle the straw for fodder use.
In the light of the above statements, choose the correct answer from the options given below:
(A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
(B) Both Assertion (A) and Reason (R) are true but R is not the correct explanation of A.
(C) Assertion (A) is true but Reason (R) is false.
(D) Assertion (A) is false but Reason (R) is true.

4. The efficiency of a mechanical thresher is heavily dependent on which of the following crop factors at the time of operation?
(A) The root length of the harvested crop
(B) The color of the mature grain
(C) The moisture content of the grain and straw
(D) The soil type of the field where the crop was grown

5. Consider the following statements regarding the threshing process:
I. Over-threshing by high cylinder speed increases grain breakage.
II. High moisture in crop during threshing improves the threshing efficiency and reduces power consumption.
III. Concave clearance adjustment is essential to prevent grain damage during threshing.
Which of the above statements is/are correct?
(A) I and II only
(B) I and III only
(C) II and III only
(D) I, II and III

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6. In a standard seed cleaner-cum-grader, the separation of impurities is primarily based on which physical properties of the produce?
(A) Taste and nutritional value
(B) Chemical composition and protein content
(C) Seed dormancy and viability
(D) Size and aerodynamic properties

7. For safe long-term storage of cereal grains like wheat, the moisture content of the grain should generally be reduced to which level to prevent microbial and insect damage?
(A) 20 to 22 percent
(B) 16 to 18 percent
(C) 10 to 12 percent
(D) 4 to 6 percent

8. Sun drying is a traditional method of drying agricultural produce. Which of the following is the main disadvantage of sun drying compared to mechanical drying?
(A) It requires a continuous supply of electrical energy for operation
(B) It causes the harvested crop to lose its complete nutritional value
(C) It depends on weather conditions and risks contamination
(D) It requires expensive machinery and heavy long-term investment

9. In sugarcane, the maturity of the crop is commonly assessed using a hand refractometer. What reading (Brix percentage) generally indicates that the sugarcane is fully mature and ready for harvesting?
(A) 8 to 10 percent
(B) 12 to 14 percent
(C) 18 to 20 percent
(D) 25 to 28 percent

10. Which index is used as a reliable indicator of maturity for harvesting mangoes intended for distant markets?
(A) Specific gravity reaches between 1.01 and 1.02
(B) When the maturing fruit drops naturally to the ground
(C) When the skin color turns completely bright red
(D) When the pulp becomes completely soft and fibrous

11. Match the crops in List I with their standard maturity indices in List II:
List I: (Crops)
P. Tomato
Q. Onion
R. Potato
S. Sugarcane
List II: (Maturity Indices)
1. Top fall or neck fall
2. Haulm turning yellow and drying
3. Turning from breaker to pink/red stage
4. Cessation of internode elongation and Brix ratio
(A) P-3, Q-1, R-2, S-4
(B) P-3, Q-2, R-1, S-4
(C) P-1, Q-3, R-4, S-2
(D) P-4, Q-1, R-2, S-3

12. Given below are two statements, one labeled as Assertion (A) and the other as Reason (R):
Assertion (A): Harvesting fruits and vegetables during the coolest part of the day, usually early morning, helps maintain better post-harvest quality.
Reason (R): Low field heat at the time of harvesting reduces the respiration rate and delays the deterioration of the produce.
In the light of the above statements, choose the correct answer from the options given below:
(A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
(B) Both Assertion (A) and Reason (R) are true but R is not the correct explanation of A.
(C) Assertion (A) is true but Reason (R) is false.
(D) Assertion (A) is false but Reason (R) is true.

13. Which traditional method of fruit and vegetable preservation works by increasing the osmotic pressure, thereby restricting microbial growth?
(A) Use of high sugar or salt concentration
(B) Brief heat treatment using boiling water or steam
(C) Thermal processing at mild heating temperatures
(D) Storage under low temperature refrigeration

14. What is the primary purpose of blanching vegetables before they are processed for freezing or dehydration?
(A) To improve the crunchiness of the final product
(B) To increase the water content of the vegetables
(C) To deactivate enzymes that cause off-flavors and color loss
(D) To completely sterilize the vegetables against all bacterial spores

15. The formation of a proper gel in jelly making primarily depends on the correct combination of which three components?
(A) Starch, Water, and Salt
(B) Pectin, Artificial color, and Preservatives
(C) Gelatin, Milk, and Sugar
(D) Pectin, Sugar, and Acid

16. According to standard specifications, what is the minimum Total Soluble Solids (TSS) percentage required in the final product of fruit jam?
(A) 45 percent
(B) 55 percent
(C) 68 percent
(D) 85 percent

17. Consider the following statements regarding the production of pickles:
I. Pickling uses the principle of fermentation by lactic acid bacteria.
II. A salt concentration of 15 to 20 percent is usually sufficient to prevent the growth of spoilage microorganisms.
III. Acetic acid (vinegar) is often added to lower the pH and act as a preservative.
IV. Pickling completely destroys all heat-resistant bacterial spores through high temperature.

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Which of the above statements are correct?
(A) I, II and IV
(B) I, II and III
(C) II, III and IV
(D) I, III and IV

18. In the canning process, exhausting is a critical step performed before sealing the cans. What is the main objective of exhausting?
(A) To rapidly cool the filled container after thermal treatment
(B) To inject carbon dioxide gas into the container for flavor enhancement
(C) To increase the internal moisture and liquid level inside the container
(D) To remove air and gases to create a partial vacuum

19. Which highly heat-resistant pathogenic bacterium is the primary target for destruction during the thermal processing (retorting) of low-acid canned foods?
(A) Clostridium botulinum
(B) Escherichia coli
(C) Staphylococcus aureus
(D) Salmonella typhi

20. Dehydration increases the shelf life of agricultural produce primarily by reducing which of the following factors to a level where microorganisms cannot grow?
(A) Protein content
(B) Total soluble solids
(C) Water activity
(D) Vitamin C content

21. Which temperature range is generally maintained in standard cold storages for storing potatoes to prevent sprouting and rotting while delaying sugar accumulation?
(A) -18 to -10 Degree Celsius
(B) 2 to 4 Degree Celsius
(C) 10 to 12 Degree Celsius
(D) 20 to 25 Degree Celsius

22. In post-harvest management, what does the term cold chain refer to?
(A) The physical process of freezing leafy vegetables in the field immediately after harvest
(B) The specialized chemical treatment applied to fruits to provide a surface cooling effect
(C) A continuous supply of chilled irrigation water to field crops prior to harvesting
(D) An uninterrupted temperature-controlled storage and logistics network

23. Modified Atmosphere Packaging (MAP) is used to preserve the quality of fresh produce. It works by altering the gaseous environment inside the package, typically by:
(A) Increasing oxygen and reducing carbon dioxide
(B) Reducing oxygen and increasing carbon dioxide
(C) Completely removing all gases to create a 100 percent vacuum
(D) Replacing all oxygen with pure nitrogen and keeping carbon dioxide at zero

24. Arrange the following steps of the commercial canning process in the correct sequential order:
1. Exhausting
2. Blanching
3. Sealing
4. Retorting (Processing)

Select the correct sequence from the options below:
(A) 2, 1, 3, 4
(B) 1, 2, 3, 4
(C) 2, 3, 1, 4
(D) 4, 3, 1, 2

25. In the traditional process of jaggery (Gur) production, which plant-based mucilaginous extract is commonly used as a clarificant to remove impurities from the boiling sugarcane juice?
(A) Clarified mucilage extracted from fresh Aloe vera leaves
(B) Aqueous extract obtained from dried Neem tree leaves
(C) Cold-pressed oil derived from cultivated castor seeds
(D) Mucilaginous extract of Deola or Bhindi stem

26. Khandsari sugar is a type of unrefined or partially refined sugar manufactured in small units. Which process is characteristically used in modern Khandsari units to separate the sugar crystals from the molasses?
(A) Centrifugation using a centrifugal machine
(B) Simple sun drying
(C) Boiling the juice until it solidifies into blocks
(D) Filtration through sand beds

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27. The efficiency of juice extraction in a sugarcane crushing mill is measured by milling efficiency. Which factor does NOT typically influence the milling efficiency?
(A) The hydraulic pressure applied on the rollers
(B) The color of the sugarcane rind
(C) The amount of imbibition water added during crushing
(D) The fiber content of the sugarcane

28. Which operation is recommended immediately before supplying sugarcane to the crusher to ensure clean juice and higher recovery?
(A) Leaving the harvested crop in the open field for several days after cutting
(B) Proper detrashing and topping of cane stalks
(C) Dipping all harvested cane stalks thoroughly into a chemical fungicidal solution
(D) Burning the leaves of cut sugarcane stalks inside a sealed enclosure

29. If 100 quintals of sugarcane are crushed and it yields 11 quintals of commercial white sugar, what is the sugar recovery percentage?
(A) 9.0 percent
(B) 10.0 percent
(C) 11.0 percent
(D) 12.0 percent

30. During the transport of fruits like tomatoes or mangoes, vibration and impact cause localized damage known as bruising. This is an example of which type of post-harvest loss?
(A) Biological loss
(B) Chemical loss
(C) Mechanical loss
(D) Pathological loss

31. Given below are two statements, one labeled as Assertion (A) and the other as Reason (R):
Assertion (A): Storing harvested sugarcane in the mill yard for several days before crushing significantly reduces the sugar recovery.
Reason (R): Post-harvest delay leads to the inversion of sucrose into glucose and fructose, facilitated by the enzyme invertase.
In the light of the above statements, choose the correct answer from the options given below:
(A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
(B) Both Assertion (A) and Reason (R) are true but R is not the correct explanation of A.
(C) Assertion (A) is true but Reason (R) is false.
(D) Assertion (A) is false but Reason (R) is true.

32. Match the post-harvest management equipment in List I with their primary function in List II:
List I: (Equipment)
P. Refractometer
Q. Hydrometer
R. Moisture Meter
S. Cold Room
List II: (Function)
1. Measures relative density or specific gravity of liquids
2. Measures water content in grains
3. Delays ripening and spoilage by low temperature
4. Measures total soluble solids (Brix) in juice
(A) P-4, Q-1, R-2, S-3
(B) P-1, Q-4, R-3, S-2
(C) P-4, Q-2, R-1, S-3
(D) P-2, Q-1, R-4, S-3

33. Consider the following statements regarding jaggery (Gur) storage:
I. Jaggery is highly hygroscopic and absorbs moisture from the atmosphere during the monsoon.
II. Storing jaggery in airtight containers or wrapping in polythene helps maintain its keeping quality.
III. High humidity and high temperature improve the color and texture of stored jaggery.
Which of the above statements is/are correct?
(A) I and II only
(B) II and III only
(C) I and III only
(D) I, II and III

34. In India, the safety and quality standards for food processing and manufacturing are governed by FSSAI. What does FSSAI stand for?
(A) Food Security and Standards Agency of India
(B) Federal Society for Standard Agriculture in India
(C) Food Storage and Supply Authority of India
(D) Food Safety and Standards Authority of India

35. For the export of fresh agricultural produce like mangoes and grapes from India, which nodal agency sets the quality guidelines and facilitates infrastructure?
(A) APEDA
(B) NABARD
(C) ICAR
(D) FCI

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36. AGMARK is a certification mark employed on agricultural products in India. AGMARK standards are legally enforced under which of the following Acts?
(A) The Food Safety and Standards Act, 2006
(B) The Essential Commodities Act, 1955
(C) The Agricultural Produce (Grading and Marking) Act, 1937
(D) The Bureau of Indian Standards Act, 1986

37. Which of the following best defines value addition in the context of increasing farmers' income?
(A) Processing produce to increase its market value and shelf life
(B) Selling the raw harvested crop immediately at the farm gate without processing
(C) Applying additional chemical fertilizers during crop growth to boost field yield
(D) Securing financial loans from commercial banks to purchase extra farm land

38. The Government of India launched the PMFME scheme to support micro food processing enterprises. Under this scheme, the approach adopted for product development and marketing is known as:
(A) Minimum Support Price (MSP)
(B) National Agriculture Market (e-NAM)
(C) Public Distribution System (PDS)
(D) One District One Product (ODOP)

39. Establishing food processing industries in rural areas primarily contributes to the rural economy by:
(A) Decreasing the overall market demand for raw farm produce in local markets
(B) Creating local employment and slowing rural migration
(C) Significantly lowering the consumer price of processed goods in urban areas
(D) Completely eliminating the requirement for institutional agricultural credit

40. The Mega Food Park scheme aims to provide a mechanism to link agricultural production to the market. The scheme is based on which model?
(A) Direct monetary subsidy and cash transfer model provided directly to individual farmers
(B) Fully automated robotic precision farming system operated without direct human intervention
(C) Hub and Spoke model linking collection and processing units
(D) Exclusively export-oriented processing zones strictly prohibiting domestic market sales

41. In the process of sugarcane milling, imbibition refers to:
(A) Filtering the raw extracted juice through high-density cloth filter mesh screens
(B) Boiling the clarified sugarcane juice in open pan evaporators under high thermal energy
(C) Drying the harvested sugarcane stalks thoroughly under direct solar radiation prior to crushing
(D) Spraying hot water on bagasse to extract residual sucrose

42. Consider the following statements regarding the handling and transportation of fresh produce:
I. Use of corrugated fibreboard (CFB) boxes reduces transportation losses compared to traditional bamboo baskets.
II. Overloading transport vehicles saves fuel costs but exponentially increases mechanical damage to the produce.
III. Pre-cooling the produce before loading into refrigerated trucks reduces the cooling load during transit.
IV. Transporting horticultural produce during the peak heat of the afternoon minimizes moisture loss.
Which of the above statements are correct?
(A) I, II and IV
(B) I, II and III
(C) II, III and IV
(D) I, III and IV

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43. In modern sugar mills, the process of clarifying sugarcane juice by heating it and treating it with milk of lime and sulfur dioxide gas is known as:
(A) Carbonation
(B) Sulfitation
(C) Pasteurization
(D) Fermentation

44. The fibrous residue left after the extraction of juice from sugarcane is termed bagasse. What is its most common and economically important use in the sugar mill itself?
(A) Processed into nutritious protein-rich feed for dairy cattle livestock
(B) Boiler fuel for generating steam and electricity
(C) Utilized as the primary organic raw material for traditional jaggery processing
(D) Disposed of directly into local landfills as an unwanted industrial waste product

45. The dark, viscous by-product left after the final crystallization of sugar, from which no more sugar can be crystallized economically, is called:
(A) Molasses
(B) Press mud
(C) Filter cake
(D) Massecuite

46. Press mud (or filter cake) is a solid waste generated during the clarification of sugarcane juice. How is it most beneficially utilized in agriculture?
(A) Formulated into a highly potent synthetic chemical pesticide for field pest management
(B) Processed into a liquid foliar spray for correcting severe crop micronutrient deficiencies
(C) Organic manure and soil ameliorant for degraded soils
(D) Applied directly as a selective chemical weedicide across commercial sugarcane fields

47. To ensure food safety, the Food Safety and Standards Authority of India (FSSAI) prescribes maximum permissible limits for which of the following in food products?
(A) Total carbohydrate content present in food products
(B) Recommended daily caloric intake and energy value
(C) Natural water percentage present in fresh fruits
(D) Heavy metal and pesticide residues

48. Match the processed agricultural products in List I with their standard base raw material in List II:
List I: (Product)
P. Khandsari
Q. Ketchup
R. Raisins
S. Marmalade
List II: (Raw Material)
1. Grapes
2. Sugarcane
3. Citrus fruits
4. Tomato
(A) P-2, Q-4, R-1, S-3
(B) P-2, Q-3, R-1, S-4
(C) P-4, Q-2, R-1, S-3
(D) P-1, Q-4, R-2, S-3

49. Which of the following represents the correct sequential steps in the commercial processing of sugarcane into white sugar?
(A) Crushing, Evaporation, Clarification, Crystallization, Centrifugation
(B) Crushing, Clarification, Evaporation, Crystallization, Centrifugation
(C) Clarification, Crushing, Crystallization, Evaporation, Centrifugation
(D) Crushing, Centrifugation, Clarification, Evaporation, Crystallization

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50. In a spike-tooth cylinder thresher, what is the primary mechanism by which grain is detached from the earhead or pod?
(A) Cutting and slicing
(B) Crushing and squeezing
(C) Chemical dissolution
(D) Impact and rubbing

51. If a freshly harvested grain sample weighs 100 grams and its bone-dry weight after oven drying is 80 grams, what is the moisture content of the grain on a wet basis?
(A) 15 percent
(B) 20 percent
(C) 25 percent
(D) 80 percent

52. In post-harvest operations, grading refers to categorizing produce based on standard market requirements. How does sorting differ from grading?
(A) Sorting is determined strictly by retail price, whereas grading depends on geographic origin
(B) Sorting involves washing raw produce, whereas grading focuses exclusively on artificial drying
(C) Separating defective produce from healthy ones before grading
(D) Sorting is applied exclusively to food grains, whereas grading is reserved only for fresh fruits

53. Visual symptoms can also act as maturity indicators in sugarcane. Which of the following visual signs indicates that sugarcane is approaching maturity?
(A) Leaf drying, yellowing crop color, and stopped top growth
(B) Rapid emergence and development of numerous fresh green tillers from the stool base

(C) Pronounced swelling across internodes along with premature bursting of lateral buds
(D) Complete softening of internal stem tissues resulting in severe field lodging

54. Pasteurization is a thermal process used extensively in the preservation of liquid foods like milk and fruit juices. Its primary objective is to:
(A) Eliminate all living microorganisms and resistant bacterial spores to achieve total sterility
(B) Enhance and stabilize the artificial color additives introduced into the fruit juice mixture
(C) Coagulate soluble plant proteins to form a dense solid mass separated from the liquid phase
(D) Kill pathogens and enzymes with minimal heat damage

55. Among the drying methods, lyophilization yields very high-quality dehydrated products. What is the common name for lyophilization?
(A) Sun drying
(B) Freeze drying
(C) Hot air oven drying
(D) Spray drying

56. Consider the following statements regarding the role of packaging in post-harvest management:
I. Proper packaging provides a barrier against physical damage and microbial contamination.
II. Packaging reduces water loss and helps maintain the turgidity of fresh vegetables.
III. Packaging material should always be completely airtight for fresh fruits to prevent them from breathing.
Which of the above statements is/are correct?
(A) I and II only
(B) I and III only
(C) II and III only
(D) I, II and III

57. A farmer who converts his raw tomato crop into tomato puree and sells it under a local brand is engaging in value addition. How does this specifically benefit the farmer's income?
(A) It legally compels government agricultural departments to grant higher financial subsidies
(B) It directly reduces the input costs of cultivation and seeds required for the next season
(C) It completely exempts agricultural landholders from paying local property and land taxes
(D) Avoids harvest price crashes and fetches premium rates

58. The formula for Pol percent (sucrose percent) and Brix percent is used to calculate the purity of sugarcane juice. Which of the following represents the correct formula for juice purity percentage?
(A) (Pol percent / Brix percent) $\times$ 100
(B) (Brix percent / Pol percent) $\times$ 100
(C) (Pol percent + Brix percent) $\times$ 100
(D) (Brix percent - Pol percent) $\times$ 100

59. The color and shelf life of jaggery (Gur) are heavily influenced by the chemical properties of sugarcane juice. High concentrations of which of the following in the juice leads to dark-colored and soft jaggery?
(A) Pure sucrose content
(B) Invert sugars
(C) Soluble calcium compounds
(D) Insoluble phosphorus salts

60. Choose the correct sequence of post-harvest operations for food grains from harvest to storage:
(A) Threshing, Harvesting, Cleaning, Drying, Storage
(B) Harvesting, Cleaning, Threshing, Drying, Storage
(C) Harvesting, Threshing, Cleaning, Drying, Storage
(D) Harvesting, Drying, Threshing, Storage, Cleaning

61. For manual harvesting of sugarcane, which specialized hand tool is most commonly used by farmers?
(A) Sickle or heavy cane knife
(B) Animal-drawn traditional wooden plough
(C) Tractor-mounted mechanical seed drill
(D) Secondary tillage tractor cultivator

62. Given below are two statements, one labeled as Assertion (A) and the other as Reason (R):
Assertion (A): The use of sulfur dioxide (SO_2) in the traditional jaggery making process is strictly monitored or discouraged.
Reason (R): Excess sulfur residue in jaggery is harmful to human health and alters the natural

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In the light of the above statements, choose the correct answer from the options given below:
(A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
(B) Both Assertion (A) and Reason (R) are true but R is not the correct explanation of A.
(C) Assertion (A) is true but Reason (R) is false.
(D) Assertion (A) is false but Reason (R) is true.

63. During the storage of grains, which of the following is a major primary storage insect pest that causes internal damage to the kernel?
(A) Field foliage grasshopper
(B) Sap-sucking plant aphid
(C) Crop vector whitefly
(D) Rice weevil

64. In the commercial canning of fruits and vegetables, what are the most common covering liquids (media) used, respectively?
(A) Salt brine for fruits and sugar syrup for vegetables
(B) Vinegar for fruits and oil for vegetables
(C) Sugar syrup for fruits and salt brine for vegetables
(D) Oil for fruits and vinegar for vegetables

65. What is the primary purpose of pre-cooling freshly harvested horticultural produce?
(A) To thoroughly wash away surface dirt, soil particles, and pesticide residues
(B) To quickly remove field heat
(C) To freeze the cellular structure of horticultural produce solid
(D) To induce uniform artificial ripening across harvested green fruits

66. Corrugated Fibre Board (CFB) boxes are widely used for packaging fruits and vegetables because they are:
(A) Significantly heavier and structurally more durable than wooden crates
(B) Completely stop the metabolic respiration process of packed produce
(C) Cannot be recycled or reused, ensuring total sanitary hygiene
(D) Lightweight, protective, and easy to print

67. The Pradhan Mantri Kisan SAMPADA Yojana (PMKSY) is a comprehensive package aimed at creating modern infrastructure for the food processing sector. Which Ministry implements this scheme?
(A) Ministry of Food Processing Industries
(B) Ministry of Agriculture and Farmers Welfare
(C) Ministry of Rural Development
(D) Ministry of Commerce and Industry

68. Value addition is not limited to the main produce. Which high-value industrial chemical is commercially produced from the fermentation of sugarcane molasses?
(A) Concentrated sulfuric acid
(B) Caustic sodium hydroxide
(C) Ethanol
(D) Anhydrous liquid ammonia

69. Match the processed product in List I with the principal preservation method used in List II:
List I: (Product)
P. Pickles
Q. Frozen Peas
R. Potato Chips
S. Canned Pineapple
List II: (Preservation Method)
1. Lowering water activity and frying (Dehydration)
2. Sub-zero temperature
3. Thermal processing in hermetically sealed containers
4. Low pH, salt, and spices
(A) P-4, Q-2, R-1, S-3
(B) P-1, Q-2, R-4, S-3
(C) P-4, Q-3, R-1, S-2
(D) P-3, Q-2, R-1, S-4

70. Consider the following statements regarding the grading of agricultural produce:
I. Grading facilitates fixing uniform prices for produce of similar quality.
II. It helps the farmer fetch a premium price for superior quality produce.
III. Standardized grading reduces the need for physical inspection of the produce by distant buyers.
IV. Grading involves mixing different varieties of a crop to create a homogenous bulk.
Which of the above statements are correct?
(A) I, II and IV
(B) II, III and IV
(C) I, II and III
(D) I, III and IV

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71. While drying usually refers to the removal of moisture under natural conditions, dehydration technically implies:
(A) Drying harvested agricultural produce

slowly in shaded areas without exposure to direct sunlight
(B) Moisture removal under controlled environmental conditions
(C) Adding synthetic chemical desiccants and moisture absorbers directly into the packaged food product
(D) Storing the fresh harvested food inside a temperature-regulated commercial cold storage room

72. In general agricultural practice, what is the best time of day to harvest leafy vegetables to ensure maximum crispness and minimum wilting during transport?
(A) Early morning
(B) At peak noon when sunlight reaches maximum intensity
(C) During the late afternoon hours after sunset
(D) At midnight using high-intensity artificial field lights

73. The specific gravity test is a common maturity index used to separate over-mature and immature fruits in water. If a harvested fruit sinks in pure water (specific gravity 1.0), it indicates that the specific gravity of the fruit is:
(A) Significantly less than 1.0
(B) Exactly equal to 1.0
(C) Above 1.0
(D) Zero or negative value

74. During jelly preparation, which simple test is commonly used to check the pectin content of the fruit extract?
(A) Alcohol test
(B) Iodine test
(C) Litmus test
(D) Benedict's test

75. To protect stored grains from severe insect infestation without leaving harmful residues in the food, which chemical is most widely used as a fumigant in godowns?
(A) Crystalline copper sulfate
(B) Phosphine
(C) Micronutrient zinc sulfate
(D) Precipitated calcium carbonate

76. An organized system is used to regulate the daily supply of harvested sugarcane to sugar mills to avoid drying and staling in the mill yard. This system operates by issuing what to the farmers?
(A) A blank bank cheque issued directly by the regional cane development officer
(B) A Parchi (supply ticket) issued by the cane society
(C) A mandatory local government tax payment receipt issued at the harvest site
(D) An advance subsidized sugarcane seed supply voucher for the next planting season

77. Consider the following statements about post-harvest losses:
I. Poor infrastructure and lack of cold chains are major reasons for high losses in perishable commodities.
II. Post-harvest losses are generally higher in cereals compared to fruits and vegetables.
III. Rodents and birds account for a significant portion of biological losses in traditional grain storage.
Which of the above statements is/are correct?
(A) I and II only
(B) II and III only
(C) I and III only
(D) I, II and III

78. Which of the following is a classic example of primary processing of an agricultural crop?
(A) Converting potatoes into packaged potato chips
(B) Baking wheat flour into bread
(C) Milling of paddy to produce brown rice
(D) Fermenting grapes to make wine

79. The establishment of Food Parks provides Common Facility Centres (CFCs). Which of the following is typically NOT a part of a CFC in a Food Park?
(A) Cold storage and deep freezers
(B) Testing laboratories for food quality
(C) Sorting, grading, and packaging lines
(D) Primary schools for farmers' children

80. From a nutritional perspective, why is traditional jaggery (Gur) often considered superior to refined white sugar?
(A) Jaggery contains zero total dietary calories compared to highly refined white sugar
(B) Jaggery naturally contains more than 99.9 percent pure crystalline sucrose content
(C) Retains iron, calcium, and minerals from cane juice
(D) Jaggery remains completely insoluble in water, serving primarily as dietary roughage

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ANSWERS

1. (B) To minimize quantitative and qualitative losses after harvesting
Post-harvest management focuses on preserving agricultural produce after harvest to maintain its market value and physical quantity. The primary objective is minimizing both quantitative losses, such as physical damage and weight reduction, and qualitative losses, including deterioration of nutritional quality, appearance, and shelf life, thereby ensuring maximum yield utilization and economic safety for growers.

2. (D) Milling of wheat into wheat flour (maida)
Primary processing includes basic operations like cleaning, grading, sorting, and drying that prepare harvested raw farm produce for storage or sale without altering its chemical identity. Secondary processing involves transforming raw agricultural products into value-added items through structural or physical changes, such as converting cleaned wheat grains into fine wheat flour through mechanical milling operations.

3. (A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
Combine harvesters streamline field harvesting by executing cutting, threshing, and cleaning simultaneously, which significantly reduces the total operational time required. However, because these machines disperse loose straw directly across the field rather than bundling or baling it, substantial crop residue remains behind, clearly demonstrating how the machine operation leaves field residue.

4. (C) The moisture content of the grain and straw
Mechanical threshing efficiency is heavily affected by the moisture levels present in crop plants during processing. High moisture causes grain damage and reduces threshing effectiveness due to excessive elasticity, whereas very low moisture makes grains brittle, leading to severe cracking. Maintaining optimal moisture content in grain and straw ensures effective separation without excessive power consumption.

5. (B) I and III only
High cylinder speed during threshing subjects grains to extreme mechanical forces, resulting in cracking and high grain breakage. Adjusting the concave clearance properly is critical to prevent grain damage during operation. Conversely, excessive moisture in crops decreases threshing efficiency and increases power demand because damp straw resists separation and clogs the cylinder assembly.

6. (D) Size and aerodynamic properties
Seed cleaner-cum-graders separate desirable seeds from undesirable impurities such as chaff, weed seeds, and undersized grains using physical dimensions and air drag characteristics. Sieves separate particles based on width and thickness, while controlled air streams utilize aerodynamic properties like terminal velocity to blow away lighter particles, resulting in thoroughly cleaned seed material.

7. (C) 10 to 12 percent
Cereal grains stored at high moisture levels experience accelerated respiration, self-heating, fungal proliferation, and severe insect infestation, leading to rapid decay. Reducing grain moisture content to ten to twelve percent creates a dry environment where metabolic activity slows down significantly and microbial growth is suppressed, ensuring safe, long-term storage without deterioration.

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8. (C) It depends on weather conditions and risks contamination
Sun drying relies completely on ambient solar radiation and atmospheric airflow, making the drying process unpredictable and slow during cloudy or humid weather conditions. Furthermore, exposing harvested crops in open areas leaves them vulnerable to contamination from windblown dust, dirt, bird droppings, insect activity, and unexpected rain showers, compromising hygiene and quality.

9. (C) 18 to 20 percent
Sugarcane maturity is accurately evaluated by determining the total soluble solids in the stalk juice using a hand refractometer. A Brix reading between eighteen and twenty percent indicates optimum sucrose accumulation and juice purity throughout the stalk, signalling that the crop

has reached peak sweetness and is ready for harvesting and milling.

10. (A) Specific gravity reaches between 1.01 and 1.02
For long-distance transportation, mangoes must be harvested at full physical maturity while remaining firm to survive transit handling. A specific gravity between 1.01 and 1.02 serves as a reliable maturity index, ensuring that mature fruits will sink or balance in water while possessing adequate starch reserves to ripen uniformly upon reaching destination markets.

11. (A) P-3, Q-1, R-2, S-4
Different agricultural crops exhibit distinct physiological indicators when reaching harvest readiness. Tomatoes show a color transition from the breaker stage to pink or red. Onions indicate maturity through top or neck fall, while potatoes display haulm yellowing and drying. Sugarcane maturity is marked by internode growth cessation and optimal juice Brix readings.

12. (A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
Harvesting fresh horticultural produce during cooler morning hours minimizes internal thermal energy, commonly known as field heat. Lower initial product temperatures decrease biological respiration rates, slow down enzymatic activity, and suppress moisture loss via transpiration, thereby effectively extending shelf life and maintaining overall product quality during subsequent handling and storage.

13. (A) Use of high sugar or salt concentration
Traditional preservation methods using high concentrations of sugar or salt create a hypertonic environment surrounding microbial cells. This high solute concentration generates high osmotic pressure, which draws water out of bacterial and fungal cells through osmosis. Dehydrating the microbes prevents their metabolic functions, effectively inhibiting growth and preserving the food product.

14. (C) To deactivate enzymes that cause off-flavors and color loss
Blanching is a short thermal treatment involving brief exposure of fresh vegetables to hot water or steam. Its primary function is the irreversible inactivation of naturally present enzymes, such as polyphenol oxidase and peroxidase, which would otherwise induce off-flavors, undesirable discoloration, nutrient degradation, and texture loss during subsequent freezing or drying operations.

15. (D) Pectin, Sugar, and Acid
Successful jelly formation relies on an equilibrium between pectin, sugar, and acid in precise proportions. Pectin forms a structural cross-linked polymer network, while sugar acts as a dehydrating agent that enables pectin molecules to aggregate. Acid lowers the pH to optimize pectin gelation, creating the firm, clear gel structure characteristic of high-quality fruit jelly.

16. (C) 68 percent
Standard food safety regulatory guidelines stipulate that commercial fruit jams must achieve a minimum total soluble solids level of sixty-eight percent by weight. Reaching this specific concentration via thermal evaporation ensures adequate sugar levels necessary for microbial preservation, proper gel consistency, desired sweetness, and long-term shelf stability at ambient room storage conditions.

17. (B) I, II and III
Pickling preserves foods by combining high salt concentration, acid accumulation, and anaerobic conditions. Lactic acid bacteria ferment sugars into lactic acid, dropping the pH. A salt level of fifteen to twenty percent prevents spoilage organisms, while added vinegar maintains acidity. Pickling does not rely on high-temperature sterilization to kill heat-resistant bacterial spores.

18. (D) To remove air and gases to create a partial vacuum
In the thermal canning sequence, exhausting involves heating the container contents prior to hermetic sealing. Heating expands the product and expels dissolved oxygen and trapped air from the headspace. Creating a partial vacuum upon cooling prevents container bulging, reduces internal oxidation of food nutrients, minimizes internal corrosion, and suppresses oxidative microbial activity.

19. (A) Clostridium botulinum
Clostridium botulinum is an anaerobic, spore-forming pathogenic bacterium that produces a lethal neurotoxin in low-acid foods. Because its bacterial endospores possess exceptional heat

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resistance, thermal processing parameters in commercial retorting are specifically calculated to achieve the complete destruction of this target organism, thereby establishing absolute microbial safety in low-acid canned food products.

20. (C) Water activity
Water activity measures the availability of unbound water in a food matrix required for biological reactions and microbial growth. Dehydration removes free water from agricultural commodities, lowering the water activity below critical thresholds. At these reduced levels, spoilage bacteria, yeasts, and molds cannot metabolize or reproduce, thereby substantially extending crop shelf life.

21. (B) 2 to 4 Degree Celsius
Cold storage of seed and table potatoes is typically maintained at two to four degrees Celsius with controlled relative humidity. This low temperature range depresses metabolic respiration, delays natural sprout development, and inhibits decay organisms. Maintaining this specific temperature regime balances sprout suppression while limiting excessive accumulation of reducing sugars through low-temperature sweetening.

22. (D) An uninterrupted temperature-controlled storage and logistics network
A cold chain represents an integrated supply chain system comprising refrigerated farm-level precooling, cold storage warehouses, insulated transport vehicles, and refrigerated retail display cabinets. Maintaining a continuous, low-temperature environment from point of harvest to final consumer prevents thermal shocks, suppresses physiological decay, and preserves perishable food quality throughout market distribution.

23. (B) Reducing oxygen and increasing carbon dioxide
Modified Atmosphere Packaging extends the post-harvest life of fresh produce by altering the internal package gas composition. Reducing oxygen concentrations and elevating carbon dioxide levels slows cellular respiration, suppresses ethylene production, delays tissue senescence, and inhibits aerobic fungal decay without causing anaerobic respiration or off-flavor formation in stored horticultural items.

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24. (A) 2, 1, 3, 4
Commercial canning follows a precise sequence to ensure safety and quality. First, blanching deactivates natural enzymes and softens product tissues. Next, exhausting removes trapped gases from the filled container headspace. The containers are then hermetically sealed immediately to maintain a vacuum. Finally, retorting provides high-temperature thermal sterilization to kill spoilage microorganisms.

25. (D) Mucilaginous extract of Deola or Bhindi stem
In cottage-scale jaggery processing, boiling raw sugarcane juice forms suspended impurities and scum on top. Adding natural vegetable clarificants, such as the mucilaginous extracts obtained from crushed stems of Deola or Bhindi, coagulates suspended non-sugar colloids and albuminoid substances. This allows easy skimming, resulting in cleaner juice and lighter-colored jaggery.

26. (A) Centrifugation using a centrifugal machine
Modern Khandsari sugar manufacture produces semi-refined sugar crystals from concentrated sugarcane juice. Following controlled crystallization in open crystallizers, the heavy mixture of sugar crystals and molasses, known as massecuite, is processed in high-speed mechanical centrifuges. Centrifugal force rapidly separates liquid molasses from the crystalline sugar, yielding distinct, dry Khandsari sugar crystals.

27. (B) The color of the sugarcane rind
Sugarcane milling efficiency reflects the percentage of sucrose extracted from cane stalks during crushing operations. Key operational parameters affecting extraction efficiency include hydraulic pressure exerted on roller mills, the quantity of imbibition water added to leach out residual juice, and the structural fiber content of the cane. Pigmentation or outer rind color has no influence on juice extraction efficiency.

28. (B) Proper detrashing and topping of cane stalks
Prior to milling harvested sugarcane, removing green leaves, dry trash, and immature tops is essential. Field trash absorbs extracted juice and reduces sucrose recovery, while immature tops contain reducing sugars and non-sugar impurities that impede juice clarification and crystallization. Proper detrashing and topping

ensure clean raw material, improving crushing efficiency and sugar yield.

29. (C) 11.0 percent
Sugar recovery percentage measures the weight of commercial sugar produced relative to the total weight of sugarcane crushed. It is calculated by dividing the output weight of sugar by the input weight of sugarcane and multiplying by one hundred. Yielding eleven quintals of sugar from one hundred quintals of sugarcane represents exactly eleven percent sugar recovery.

30. (C) Mechanical loss
Mechanical losses during post-harvest handling arise from physical forces such as vibration, drop impact, surface abrasion, compression, or crushing during field collection, packing, and road transport. Bruising on perishable commodities like tomatoes or mangoes ruptures internal tissue cell walls without breaking the skin, leading to physical damage, accelerated softening, localized discoloration, and structural degradation.

31. (A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
Delaying the crushing of harvested sugarcane leads to rapid deterioration in quality. Post-harvest cut stalks undergo enzymatic inversion, where the enzyme invertase breaks down non-reducing sucrose into reducing sugars like glucose and fructose. This metabolic inversion reduces recoverable sucrose, increases molasses formation, hampers juice crystallization, and significantly lowers overall sugar recovery percentages in commercial mills.

32. (A) P-4, Q-1, R-2, S-3
Specific instruments serve distinct analytical roles in post-harvest technology. Refractometers measure refractive index to determine total soluble solids in juices, while hydrometers measure liquid specific gravity. Electronic moisture meters calculate moisture percentage in agricultural seeds, and low-temperature cold rooms extend product storage life by delaying metabolic activity and preventing physiological spoilage.

33. (A) I and II only
Jaggery contains hydrophilic non-sucrose compounds that make it highly hygroscopic, causing it to absorb atmospheric moisture rapidly under humid conditions. High moisture absorption leads to deliquescence, microbial fermentation, and quality degradation. Storing jaggery in airtight containers or moisture-proof polythene packaging protects it from ambient humidity, whereas elevated temperature and humidity degrade product color and texture.

34. (D) Food Safety and Standards Authority of India
FSSAI stands for Food Safety and Standards Authority of India, an autonomous statutory body established under the Ministry of Health and Family Welfare. Created under the Food Safety and Standards Act, 2006, FSSAI is responsible for laying down science-based standards for food items and regulating their manufacture, storage, distribution, sale, and import.

35. (A) APEDA
APEDA, short for the Agricultural and Processed Food Products Export Development Authority, functions under the Ministry of Commerce and Industry. It serves as the primary export promotion agency in India, formulating quality guidelines, facilitating infrastructure development, setting sanitary standards, and promoting global market access for fresh horticultural produce such as mangoes, grapes, and citrus fruits.

36. (C) The Agricultural Produce (Grading and Marking) Act, 1937
AGMARK is a legal quality certification seal employed on agricultural commodities in India to assure quality and purity. The implementation and regulation of AGMARK standards are legally backed by the Agricultural Produce Grading and Marking Act, 1937, which empowers the Directorate of Marketing and Inspection to define quality grade specifications for raw and processed agricultural products.

37. (A) Processing produce to increase its market value and shelf life
Value addition in agriculture involves converting raw harvested farm produce into processed or refined products through primary or secondary post-harvest operations. By transforming perishable commodities into stabilized, packaged, or transformed items, farmers enhance product shelf life, create consumer utility, capture higher market margins, and mitigate risks associated

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with post-harvest spoilage and farmgate price fluctuations.

38. (D) One District One Product (ODOP)
The Pradhan Mantri Formalisation of Micro Food Processing Enterprises scheme promotes unorganized micro-enterprises in the food sector. To maximize economic scale, branding, and supply chain synergy, the scheme adopts the One District One Product approach, identifying specialized agricultural produce per district to streamline raw material sourcing, infrastructure, testing facilities, marketing, and market linkage.

39. (B) Creating local employment and slowing rural migration
Establishing localized food processing units in rural areas bridges the gap between agricultural production and market demand. It creates employment opportunities across collection, grading, processing, and packaging operations, enhancing local farm incomes. Diversifying the rural economic structure reduces seasonal unemployment and discourages distress migration of agricultural workers toward congested urban centers.

40. (C) Hub and Spoke model linking collection and processing units
The Mega Food Park scheme provides modern post-harvest infrastructure by functioning on a Hub and Spoke operational framework. Primary Processing Centres and Collection Centres act as spokes situated near farm gates to handle aggregation, sorting, and precooling. These feed directly into the Central Processing Centre hub, where advanced processing, cold storage, and distribution facilities operate.

41. (D) Spraying hot water on bagasse to extract residual sucrose
Imbibition is a key extraction step in sugarcane milling operations where water or thin juice is sprayed onto bagasse mats moving between crushing rollers. Adding hot imbibition water dilutes remaining sugar juice trapped within plant fibers, facilitating maximum sucrose recovery and significantly improving overall extraction efficiency during the mechanical crushing process.

42. (B) I, II and III
Safe transit of fresh produce relies on protective packaging and temperature management. Corrugated fibreboard boxes provide cushioning that minimizes mechanical abrasion compared to traditional rigid baskets. Vehicle overloading leads to severe compression damage and bruising, while pre-cooling harvested produce lowers initial thermal loads, improving refrigerated transport efficiency and preserving quality.

43. (B) Sulfitation
Sulfitation is a widely used chemical clarification technique in modern white sugar manufacturing. Raw sugarcane juice is heated and treated with milk of lime and sulfur dioxide gas. Lime neutralizes natural organic acids and precipitates insoluble calcium salts, while sulfur dioxide bleaches plant pigments and acts as a preservative, producing clarified juice for sugar boiling.

44. (B) Boiler fuel for generating steam and electricity
Bagasse is the fibrous pulp residual material remaining after crushing sugarcane stalks in milling plant rollers. In modern integrated sugar processing plants, bagasse is utilized internally as a primary biofuel burned in boiler furnaces to generate high-pressure steam. This steam drives crushing turbines and powers generators, providing self-sufficient electricity for factory operations.

45. (A) Molasses
Molasses is the dark, dense, viscous syrup separated from massecuite during high-speed centrifugal separation in sugar refineries. Representing the ultimate liquid by-product of sugar crystallization, it contains unrecoverable sucrose along with invert sugars, ash, and organic non-sugars, serving as a primary carbon feedstock for commercial industrial alcohol and ethanol production plants.

46. (C) Organic manure and soil ameliorant for degraded soils
Press mud, also referred to as filter cake, is a solid residue generated during sugarcane juice clarification and filtration operations. Rich in organic carbon, nitrogen, phosphorus, calcium, and trace micronutrients, press mud is utilized as an effective organic manure and soil conditioner, improving water holding capacity and nutrient availability in agricultural soils.

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47. (D) Heavy metal and pesticide residues
Food safety regulations enforced by the Food Safety and Standards Authority of India establish legal limits for potential toxic contaminants in food products. FSSAI prescribes maximum residue limits for chemical pesticides, heavy metals like lead and arsenic, mycotoxins, and veterinary drugs to protect consumers from acute toxicity and long-term health hazards associated with contaminated food intake.

48. (A) P-2, Q-4, R-1, S-3
Specific agricultural crops serve as key primary raw materials for distinct value-added processed items. Semi-refined Khandsari is manufactured directly from sugarcane juice, while tomato forms the natural liquid base for commercial ketchup. Dehydrating ripe grapes produces dried raisins, and utilizing citrus fruits along with peel shreds yields traditional fruit marmalade.

49. (B) Crushing, Clarification, Evaporation, Crystallization, Centrifugation
White sugar manufacturing follows an established industrial processing sequence. Sugarcane first undergoes mechanical crushing to extract raw juice. The extracted juice undergoes chemical clarification using lime and heat to eliminate impurities. Clarified juice is concentrated via multi-effect evaporation into heavy syrup, which undergoes controlled crystallization before centrifuges separate sugar crystals from liquid molasses.

50. (D) Impact and rubbing
Spike-tooth cylinder threshers extract mature grains from crops using mechanical forces. As harvested crop plants pass through the narrow clearance between the rotating spiked cylinder and stationary concave, high-speed impact blows detach kernels from earheads, while intense rubbing action between plant stalks completes grain separation without causing excessive kernel shattering.

51. (B) 20 percent
Wet-basis moisture content expresses the mass of water present in a sample as a percentage of its total initial wet weight. Subtracting the dry weight of eighty grams from the initial sample weight of one hundred grams reveals twenty grams of moisture. Dividing twenty grams by one hundred grams yields exactly twenty percent moisture on a wet basis.

52. (C) Separating defective produce from healthy ones before grading
Sorting and grading represent distinct steps in post-harvest crop handling. Sorting is an initial preliminary operation that separates damaged, diseased, insect-infested, or deformed produce from sound and healthy crop items. Grading follows sorting, categorizing the remaining sound produce into homogenous quality classes based on size, color, weight, shape, and overall market standards.

53. (A) Leaf drying, yellowing crop color, and stopped top growth
Sugarcane field maturity manifests through observable physical changes in crop morphology. As stalks reach full maturity and sucrose content reaches maximum levels, vegetative terminal growth ceases, top internode elongation stops, and lower foliage undergoes natural yellowing and desiccation. These visual indicators signal farmers that the crop is ready for harvesting.

54. (D) Kill pathogens and enzymes with minimal heat damage
Pasteurization is a mild thermal preservation process applying specific heating regimes to liquid foods like milk and fruit juices. Its objective is to destroy vegetative pathogenic bacteria and deactivate quality-degrading enzymes while retaining natural flavor, color, appearance, and nutritional quality without achieving complete commercial sterility associated with extreme heat treatments.

55. (B) Freeze drying
Lyophilization, commonly known as freeze drying, is an advanced dehydration technique used for delicate, heat-sensitive food products. The material is first rapidly frozen, after which water is removed directly via sublimation under deep vacuum conditions. Bypassing the liquid phase preserves natural cell structure, nutritional value, aroma compounds, and rehydration capability.

56. (A) I and II only
Packaging serves critical post-harvest functions by offering physical protection against mechanical impacts, dirt contamination, and microbial infection, while minimizing water transpiration to maintain fruit turgidity. However, fresh living produce requires continuous aerobic respiration; using completely airtight, non-

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ventilated packaging material creates anaerobic conditions, leading to rapid fermentation, severe physiological disorders, and product spoilage.

57. (D) Avoids harvest price crashes and fetches premium rates
Transforming raw perishable crops like tomatoes into shelf-stable processed items like tomato puree shields farm producers from post-harvest price crashes caused by seasonal market gluts. Processing extends product marketability far beyond immediate harvest periods, allowing farmers to sell value-added products year-round and command premium retail prices, directly boosting net farm earnings.

58. (A) (Pol percent / Brix percent) x 100
Sugarcane juice purity percentage reflects the proportion of actual sucrose relative to total dissolved solids in juice. Pol percent indicates the sucrose concentration, while Brix percent represents the total dissolved solids. Calculating juice purity requires dividing Pol percent by Brix percent and multiplying the resulting decimal by one hundred, establishing an essential mill efficiency metric.

59. (B) Invert sugars
Invert sugars, consisting of equal parts glucose and fructose, strongly influence jaggery quality during processing. High invert sugar levels in raw sugarcane juice impair sucrose crystallization, increase moisture absorption due to high hygroscopic properties, and accelerate Maillard browning reactions during open-pan juice boiling, resulting in dark, soft, and sticky jaggery.

60. (C) Harvesting, Threshing, Cleaning, Drying, Storage
Food grain handling follows a strict operational sequence post-crop growth. Field crop stalks are first harvested at maturity. Threshing separates grains from earheads or panicles, followed by cleaning to remove winnowed chaff and trash. Grains are subsequently dried to safe equilibrium moisture levels before placement into long-term grain storage structures.

61. (A) Sickle or heavy cane knife
Manual harvesting of sugarcane in farming regions relies on specialized hand tools. Farmers employ curved sickles or heavy, broad-bladed cane knives to cut mature sugarcane stalks cleanly at ground level, remove top foliage, and strip lateral leaves efficiently before bundling the cut stalks for transportation to mills or processing units.

62. (A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
Bleaching jaggery using sulfur dioxide during juice boiling improves product color, but leaves chemical sulfur residues in the finished product. Excess sulfur content alters natural jaggery flavor, imparts a pungent chemical taste, and poses health risks to consumers. Consequently, food safety regulations discourage sulfur dioxide usage in organic jaggery manufacture.

63. (D) Rice weevil
The rice weevil, Sitophilus oryzae, is a destructive primary storage insect pest attacking stored cereal grains like wheat, rice, and maize. Female adult weevils bore holes into whole, sound grain kernels to deposit eggs inside. Developing larvae feed internally within the kernel, consuming endosperm tissue, creating hollowed grains, and causing significant quantitative loss.

64. (C) Sugar syrup for fruits and salt brine for vegetables
In commercial canning operations, appropriate covering liquids facilitate heat transfer, preserve product integrity, and enhance flavor. Fruits are typically packed in refined sugar syrups of varying concentrations to preserve original cell sweetness and firm texture. Vegetables are packed in light salt brine solutions to maintain product firmness, pH balance, and natural flavor profiles.

65. (B) To quickly remove field heat
Pre-cooling involves rapidly lowering the internal temperature of freshly harvested horticultural crops immediately prior to cold storage or transport. Removing accumulated field heat depresses crop respiration rates, slows enzymatic degradation, reduces moisture loss from transpiration, and inhibits post-harvest microbial growth, thereby preserving tissue freshness, original appearance, and extending post-harvest storage stability.

66. (D) Lightweight, protective, and easy to print
Corrugated Fibreboard boxes are standard packaging containers in modern fresh produce marketing. Constructed with fluted paperboard

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layers, CFB boxes provide excellent structural shock absorption, cushioning fruits against physical impact damage. Their lightweight construction reduces freight costs, while smooth outer surfaces allow high-quality printing for consumer branding, barcoding, and product marketing information.

67. (A) Ministry of Food Processing Industries
The Pradhan Mantri Kisan SAMPADA Yojana is a comprehensive flagship central sector scheme implemented directly by the Ministry of Food Processing Industries. It aims to modernize post-harvest infrastructure, reduce farmgate losses, create robust cold chain logistics networks, and promote value-added food processing industries across agricultural clusters throughout India.

68. (C) Ethanol
Sugarcane molasses, a carbon-rich residual by-product of sugar crystallization, serves as an essential raw substrate for microbial fermentation. Commercial industrial distilleries ferment molasses using yeast strains like Saccharomyces cerevisiae to convert fermentable sugars into ethanol. Ethanol is extensively utilized as biofuel for gasoline blending, solvent manufacturing, and chemical synthesis.

69. (A) P-4, Q-2, R-1, S-3
Processing techniques employ distinct scientific principles to preserve foods. Pickling utilizes low pH, high salt, and aromatic spices to restrict spoilage. Freezing green peas at sub-zero temperatures halts biological decay. Dehydrating potato slices via high-temperature frying lowers water activity, while canning pineapple involves thermal processing in hermetically sealed metal containers.

70. (C) I, II and III
Grading categorizes harvested agricultural produce into homogenous quality grades based on specific physical parameters like size, shape, color, and freedom from defects. Standardized grading enables fair pricing, enables growers to secure premium returns for high-quality items, and allows trading based on established specifications, reducing physical inspection needs. Mixing varieties contradicts grading objectives.

71. (B) Moisture removal under controlled environmental conditions
While open sun drying relies on unpredictable ambient solar energy and wind, dehydration specifically refers to artificial moisture removal using engineered equipment under strictly controlled conditions. Dehydration units precisely regulate processing parameters such as drying temperature, airflow velocity, and relative humidity, ensuring uniform moisture reduction, superior product hygiene, and enhanced quality retention.

72. (A) Early morning
Leafy vegetables should ideally be harvested during early morning hours when ambient temperatures are low and humidity is high. At daybreak, plant tissues exhibit maximum cell turgidity from nighttime water uptake and low transpiration. Harvesting early reduces field heat, minimizes post-harvest water loss, prevents rapid wilting, and prolongs freshness during handling.

73. (C) Above 1.0
Specific gravity testing is an established physical method to evaluate fruit maturity. As fruits mature on trees, dry matter content, starch accumulation, and sugar concentrations increase, gradually increasing the fruit density. When a harvested fruit sinks completely in pure water with a density of 1.0, it proves its specific gravity is above 1.0.

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74. (A) Alcohol test
The alcohol test is a quick qualitative method used to estimate pectin content in boiled fruit extracts during jelly preparation. Adding ethyl alcohol to fruit juice precipitates dissolved pectin into jelly-like clots. Observing whether a single firm clot or multiple broken fragments form indicates whether the pectin concentration is sufficient for successful gel structure.

75. (B) Phosphine
Phosphine gas, generated from solid aluminium phosphide tablets reacting with atmospheric moisture, is the primary chemical fumigant utilized for insect pest control in grain godowns. Phosphine penetrates deeply into stored grain masses to kill all life stages of pests without leaving dangerous chemical residues or affecting seed germination when applied under proper aeration.

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76. (B) A Parchi (supply ticket) issued by the cane society
Sugar mill supply chains organize sugarcane delivery using a regulated supply ticket system known as a Parchi. Issued by cooperative cane development societies based on crop maturity surveys, the Parchi specifies delivery dates and quantities for individual farmers, preventing yard congestion, minimizing post-harvest delays, and ensuring fresh cane crushing at factories.

77. (C) I and III only
Post-harvest losses stem from inadequate cold storage infrastructure, which severely impacts perishable fruits and vegetables far more than durable cereal grains. Additionally, biological vectors like rodents and birds consume and contaminate substantial quantities of stored grains in traditional storage structures. Consequently, loss percentages in fresh fruits are higher than in grains.

78. (C) Milling of paddy to produce brown rice
Primary processing consists of initial mechanical post-harvest operations that prepare raw farm produce for direct consumption or subsequent industrial processing without drastically altering its natural composition. Milling harvested paddy in rice mills to remove outer husk layers and yield edible brown rice serves as a classic example of primary post-harvest processing.

79. (D) Primary schools for farmers' children
Common Facility Centres in modern Mega Food Parks aggregate shared industrial processing infrastructure to support food entrepreneurs. Key technical facilities include cold storages, deep freezers, quality testing laboratories, sorting and grading lines, and steam utilities. General social infrastructure like primary schools falls outside the operational domain of commercial food processing facility hubs.

80. (C) Retains iron, calcium, and minerals from cane juice
Jaggery is produced by evaporating raw sugarcane juice without undergoing chemical refining or bleaching processes. Consequently, it retains natural mineral elements present in sugarcane, including iron, calcium, phosphorus, magnesium, and potassium. In contrast, white sugar undergoes extensive chemical refining that strips away micro-nutrients, leaving pure sucrose devoid of essential dietary minerals.

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CHAPTER 04
Crop Rotation and Farming Systems

1. What is the fundamental principle of crop rotation regarding the root system of successive crops?
(A) Deep-rooted crops should be followed by shallow-rooted crops.
(B) Shallow-rooted crops should be followed by shallow-rooted crops.
(C) Deep-rooted crops should be followed by deep-rooted crops.
(D) Only tap-rooted crops should be grown continuously.

2. Match List I with List II:
List I: (Indigenous inputs/concepts in Natural Farming)
P. Beejamrit
Q. Jeevamrit
R. Acchadana
S. Whapasa
List II: (Primary function)
1. Soil moisture and aeration
2. Soil microbial enhancer
3. Seed treatment
4. Mulching and microclimate management
(A) P-3, Q-2, R-4, S-1
(B) P-2, Q-3, R-4, S-1
(C) P-3, Q-1, R-2, S-4
(D) P-1, Q-2, R-3, S-4

3. Which of the following is the primary benefit of including pulse crops in a sugarcane-based crop rotation?
(A) They fix atmospheric nitrogen and improve soil structure.
(B) They increase the requirement for chemical nitrogen fertilizer in the succeeding crop.
(C) They extract moisture exclusively from deeper soil layers.
(D) They secrete allelopathic chemicals that suppress sugarcane sprouting.

4. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): Zero tillage technique helps in reducing the cost of cultivation and saves time for sowing wheat after paddy harvest.
Reason (R): Zero tillage completely eliminates the need for any herbicide application in the crop cycle.
In the light of the above statements, choose the correct answer from the options given below:
(A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
(B) Both Assertion (A) and Reason (R) are true but R is not the correct explanation of A.
(C) Assertion (A) is true but Reason (R) is false.
(D) Assertion (A) is false but Reason (R) is true.

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5. In agricultural classification, "Dry Farming" is typically recommended for regions receiving an annual rainfall of less than:
(A) 750 mm
(B) 1150 mm
(C) 1500 mm
(D) 2000 mm

6. Consider the following statements regarding the basic pillars of Conservation Agriculture:
I. Minimum soil disturbance.
II. Permanent soil cover with crop residues or cover crops.
III. Deep summer ploughing every year to expose weed seeds.
Which of the above statement(s) is/are correct?
(A) I and II only
(B) II and III only
(C) I and III only
(D) I, II and III

7. Which of the following companion crops is highly recommended as an autumn-planted intercrop in sugarcane in Uttar Pradesh to ensure early income without adversely affecting sugarcane yield?
(A) Paddy
(B) Sorghum
(C) Bajra
(D) Mustard

8. Arrange the following steps of the NPOP organic certification process in the correct order:

1. On-site inspection by the certification body
2. Application submission by the farmer/group
3. Issuance of the Scope Certificate
4. Review of the inspection report

(A) 2, 1, 4, 3
(B) 1, 2, 3, 4
(C) 2, 4, 1, 3
(D) 1, 3, 2, 4

9. Sowing of a succeeding crop in a standing crop before the harvest of the preceding crop is known as:
(A) Ratoon cropping
(B) Relay cropping
(C) Alley cropping
(D) Strip cropping

10. What is the fundamental difference between mixed cropping and mixed farming?
(A) Mixed cropping involves cultivating different crop varieties, while mixed farming focuses exclusively on distinct crop species.
(B) Mixed cropping grows crops together, while mixed farming combines crop production with livestock.
(C) Mixed cropping requires continuous artificial irrigation, while mixed farming is practiced exclusively in arid drylands.
(D) Mixed cropping relies on synthetic chemical fertilizers, while mixed farming depends solely on farm-derived organic manures.

11. Consider the following statements regarding the Sugarcane-Wheat crop rotation:
I. It is one of the most prominent cropping systems in Western Uttar Pradesh.
II. Wheat is typically sown late after the harvest of ratoon sugarcane.
III. Late sowing of wheat generally results in an increased yield compared to timely sowing.
IV. The inclusion of an intermediate leguminous green manure crop like Dhaincha improves the sustainability of this rotation.
Which of the above statement(s) is/are correct?
(A) I, II and III
(B) I, II and IV
(C) II, III and IV
(D) I, III and IV

12. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): Crop rotation is an effective cultural method to break the life cycle of host-specific pests.
Reason (R): Growing non-host crops in succession deprives the pest of its food source, thereby reducing its population.
In the light of the above statements, choose the correct answer from the options given below:
(A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
(B) Both Assertion (A) and Reason (R) are true but R is not the correct explanation of A.
(C) Assertion (A) is true but Reason (R) is false.
(D) Assertion (A) is false but Reason (R) is true.

13. Which of the following statements about Natural Farming is incorrect?
(A) It promotes soil aeration and minimal tillage practices.
(B) Cow dung and cow urine are the main components of microbial cultures used in it.
(C) It works on the principle of a closed system where minimal or no inputs are brought from outside the farm.
(D) It relies heavily on off-farm purchased inputs like chemical fertilizers and synthetic pesticides.

14. Match List I with List II:
List I: (Term)
P. Monocropping
Q. Intercropping
R. Multiple cropping
S. Ratoon cropping
List II: (Definition)
1. Growing two or more crops simultaneously in definite row arrangements
2. Growing only one crop on a piece of land year after year
3. Cultivating the regrowth from the stubble of a harvested crop
4. Growing two or more crops on the same field in one calendar year

(A) P-2, Q-1, R-4, S-3
(B) P-1, Q-2, R-3, S-4
(C) P-4, Q-3, R-1, S-2
(D) P-2, Q-4, R-1, S-3

15. In dryland farming, which agronomic practice is primarily adopted to check evaporative moisture loss from the soil surface?
(A) Puddling
(B) Mulching
(C) Deep ploughing
(D) Flooding

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16. When planting autumn sugarcane with potato as an intercrop, the most common and recommended row ratio for maximum mutual compatibility is usually:
(A) 1 row of sugarcane : 2 rows of potato
(B) 4 rows of sugarcane : 1 row of potato
(C) 1 row of sugarcane : 4 rows of potato
(D) 3 rows of sugarcane : 3 rows of potato

17. Select the correct sequence of cropping systems in ascending order of Cropping Intensity (from lowest to highest):
(A) Mono cropping → Double cropping → Relay cropping
(B) Relay cropping → Double cropping → Mono cropping
(C) Double cropping → Mono cropping → Relay cropping
(D) Mono cropping → Relay cropping → Double cropping

18. The core objective of an Integrated Farming System (IFS) is to:
(A) Maximize the application of synthetic agrochemicals to push crop yields beyond their natural genetic potential.
(B) Focus exclusively on high-value commercial cash crops to generate maximum foreign exchange earnings.
(C) Integrate agricultural enterprises to minimize risk and recycle farm waste efficiently.
(D) Replace all skilled human labor entirely with automated heavy agricultural machinery.

19. Crop rotation provides multiple agronomic benefits. Which of the following is NOT a direct benefit of adopting crop rotation?
(A) Enhancing the genetic mutation rate of crop seeds.
(B) Effective weed control, particularly suppressing parasitic weed growth.
(C) Prevention of selective nutrient depletion from specific soil profile layers.
(D) Maintenance and long-term improvement of soil physical and biological properties.

20. The practice of leaving land uncultivated for a season or more to allow it to recover its fertility naturally is known as:
(A) Puddling
(B) Ratooning
(C) Staking
(D) Fallowing

21. Consider the following statements differentiating Natural Farming from Organic Farming:
I. Organic farming permits the use of organic fertilizers like bulky vermicompost and FYM.
II. Natural farming requires no addition of bulky external fertilizers, emphasizing on-farm microbial cultures.
III. Both organic and natural farming allow the use of urea if the crop exhibits severe nitrogen deficiency.
Which of the above statement(s) is/are correct?
(A) I and II only
(B) II and III only
(C) I and III only
(D) I, II and III

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22. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): In dryland farming areas, crops with deep root systems and short life cycles are preferred.
Reason (R): Deep roots can extract moisture from lower soil profiles and short-duration crops escape terminal drought.
In the light of the above statements, choose the correct answer from the options given below:
(A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
(B) Both Assertion (A) and Reason (R) are true but R is not the correct explanation of A.
(C) Assertion (A) is true but Reason (R) is false.
(D) Assertion (A) is false but Reason (R) is true.

23. In natural farming, Beejamrit is primarily used as a:
(A) Broad-spectrum foliar spray application designed to effectively control leaf-eating caterpillars.
(B) Soil-applied granular bio-fertilizer formulation intended for essential basal application.
(C) Selective contact herbicide formulation applied to eliminate persistent broad-leaved weeds.
(D) Seed treatment to prevent seed-borne diseases and boost germination.

24. Match List I with List II:
List I: (Rotation principle)
P. Legume crop after cereal
Q. Deep-rooted crop after shallow-rooted
R. Broad-leaved crop after narrow-leaved

S. Less water requiring crop after high water requiring

List II: (Agronomic reason)

1. Exploits nutrients from different soil depths
2. Restores soil nitrogen
3. Helps in weed management and breaks pest cycles
4. Manages soil moisture efficiently

(A) P-2, Q-1, R-3, S-4
(B) P-1, Q-2, R-4, S-3
(C) P-3, Q-4, R-1, S-2
(D) P-2, Q-3, R-1, S-4

25. The advantage of intercropping over sole cropping is generally quantified using the Land Equivalent Ratio (LER). Intercropping is considered biologically advantageous when the LER is:
(A) Exactly 0
(B) Less than 1.0
(C) Exactly 1.0
(D) Greater than 1.0

26. Which of the following refers to agricultural practices that meet current food needs without compromising the ability of future generations to meet their own needs?
(A) Intensive subsistence agriculture
(B) Sustainable agriculture
(C) Precision agriculture
(D) Shifting agriculture

27. Consider the following statements regarding zero tillage:
I. It significantly reduces carbon emissions by saving tractor fuel.
II. It requires specialized machinery like the Happy Seeder or Zero Till Seed Drill.
III. It accelerates soil erosion due to continuous soil crusting.
IV. It enhances the accumulation of organic carbon in the topsoil over time.

Which of the above statement(s) is/are correct?
(A) I, II and III
(B) I, II and IV
(C) II, III and IV
(D) I, III and IV

28. In India, the National Programme for Organic Production (NPOP) is implemented by which of the following agencies?
(A) NABARD
(B) ICAR
(C) APEDA
(D) FCI

29. In the context of Uttar Pradesh, which among the following is considered an ideal sugarcane-based crop rotation to restore soil health?
(A) Spring Sugarcane - Ratoon Sugarcane - Late Sown Wheat
(B) Spring Sugarcane - Ratoon - Monsoon Paddy - Late Sown Wheat
(C) Grain Sorghum - Rainfed Pearl Millet - Spring Sugarcane
(D) Green Manure - Autumn Sugarcane - Ratoon - Wheat

30. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): Relay cropping is often compared to a relay race where the baton is passed before the runner stops.
Reason (R): In relay cropping, the seeds of the succeeding crop are sown only after the primary crop has been harvested and the field is tilled.
In the light of the above statements, choose the correct answer from the options given below:
(A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
(B) Both Assertion (A) and Reason (R) are true but R is not the correct explanation of A.
(C) Assertion (A) is true but Reason (R) is false.
(D) Assertion (A) is false but Reason (R) is true.

31. What is meant by 'Partial Organic Farming'?
(A) Traditional subsistence farming where exactly half of the farm field is cultivated while the remaining land is kept permanently fallow.
(B) Combining minimal inorganic fertilizers with predominantly organic manure application.
(C) Arid rainfed farming completely conducted without the application of any supplementary irrigation water.
(D) An intensive farming system where synthetic chemical pesticides are used heavily, while crop fertilizers remain strictly organic.

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32. Under standard certification guidelines, what is the correct chronological sequence to achieve fully certified organic status for a conventional farm?
(A) Conventional farming → In-conversion period → Fully certified organic
(B) Fully certified organic → In-conversion period → Conventional farming

(C) In-conversion period → Conventional farming → Fully certified organic
(D) Conventional farming → Fully certified organic → In-conversion period

33. The systematic arrangement and management of crops and livestock in a specific environment by a farmer is technically termed as:
(A) Farming system
(B) Cropping pattern
(C) Cropping system
(D) Farm mechanization

34. When selecting a companion crop for intercropping, which of the following principles of compatibility should be followed?
I. The companion crop should have a different growth habit and canopy structure.
II. Peak nutrient demand of both crops should occur at the exact same time.
III. There should be a considerable difference in the root depths of the two crops.
Which of the above statement(s) is/are correct?
(A) I and II only
(B) I and III only
(C) II and III only
(D) I, II and III

35. One of the key principles of conservation agriculture is maintaining a permanent soil cover. Generally, what minimum percentage of soil cover by crop residues is recommended?
(A) 10%
(B) 30%
(C) 70%
(D) 100%

36. Match List I with List II:
List I: (Farming system component)
P. Apiculture
Q. Vermicomposting
R. Silviculture
S. Aquaculture
List II: (Primary output/role)
1. Timber and fodder
2. Honey and pollination
3. Fish production
4. Earthworm-processed manure
(A) P-2, Q-4, R-1, S-3
(B) P-1, Q-3, R-2, S-4
(C) P-4, Q-2, R-3, S-1
(D) P-2, Q-1, R-4, S-3

37. Which of the following intercrops is strongly discouraged with sugarcane because it acts as an alternate host for early shoot borer and competes heavily for nutrients?
(A) Garlic
(B) Maize
(C) Coriander
(D) Gram (Chickpea)

38. Mixed cropping, where seeds of two or more crops are mixed before sowing and broadcasted without definite row arrangement, is primarily adopted by dryland farmers to:
(A) Ensure complete operational ease during mechanized crop harvesting.
(B) Significantly maximize the commercial export quality of harvested grains.
(C) Minimize total crop failure risk from aberrant weather.
(D) Facilitate highly precise target application of chemical herbicides.

39. Consider the following ingredients used in the preparation of 'Jeevamrit' for natural farming:
I. Cow dung
II. Cow urine
III. Jaggery (Gur)
IV. Synthetic Urea
Which of the above statement(s) is/are correct?
(A) I, II and III
(B) I, II and IV
(C) II, III and IV
(D) I, III and IV

40. Which among the following techniques is considered a fundamental practice of Climate-Resilient Agriculture to mitigate drought stress?
(A) Growing drought-tolerant varieties and harvesting rainwater.
(B) Indiscriminate and uncontrolled extraction of deep groundwater resources.
(C) Continuous monoculture cultivation of high water-demanding cash crops.
(D) Complete physical removal and open field burning of all crop residues.

41. Which one of the following sequences represents an INCORRECT scientific principle of crop rotation?
(A) Heavy nutrient-exhaustive crops should always be followed by soil-restorative crops.
(B) Growing crops susceptible to the same soil-borne diseases consecutively.
(C) Nitrogen-fixing leguminous crops should

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ideally be grown after non-leguminous crops.
(D) Deep-rooted crop species should systematically be rotated with shallow-rooted crops.

42. In standard agronomy, how is the 'Cropping Intensity' of a farm calculated?
(A) (Net sown area / Gross cropped area) × 100
(B) (Gross cropped area / Net sown area) × 100
(C) (Total yield / Net sown area) × 100
(D) (Net sown area / Total fallow land) × 100

43. To conserve water in dry farming areas, anti-transpirants are sometimes sprayed on crop foliage. Which of the following is an example of a stomata-closing type anti-transpirant?
(A) Phenyl Mercuric Acetate (PMA)
(B) Kaolin particulate spray
(C) Cycocel plant growth retardant
(D) Linseed oil reflective emulsion

44. Consider the following strategies for effective fallow land management:
I. Keeping the land entirely barren with excessive deep ploughing to dry out moisture.
II. Growing green manure crops during the fallow period and incorporating them into the soil.
III. Establishing short-duration cover crops to prevent soil erosion.
Which of the above statement(s) is/are correct?
(A) I and II only
(B) II and III only
(C) I and III only
(D) I, II and III

45. Which state in India was the first to be officially declared as a 100% Organic State?
(A) Uttar Pradesh
(B) Punjab
(C) Kerala
(D) Sikkim

46. What is the primary reason organic agricultural products often carry a 'premium market value'?
(A) They possess significantly larger grain sizes and display artificially enhanced bright colors.
(B) They mandate massive financial investments in synthetic high-grade chemical fertilizers.
(C) They are healthy and produced using sustainable, chemical-free methods.
(D) They are reserved exclusively for export and strictly prohibited from domestic sale.

47. Identify the incorrectly matched pair regarding farming systems:
(A) Silviculture - Forest trees cultivation
(B) Pomology - Pulse crops cultivation
(C) Olericulture - Vegetable farming
(D) Floriculture - Flower farming

48. What is the primary agronomic advantage of adopting a 'Sugarcane - Ratoon - Wheat' sequence in Northern India?
(A) It completely eliminates the total operational requirement for supplementary irrigation in sugarcane.
(B) Wheat naturally fixes and automatically supplies required nitrogen to subsequent sugarcane crops.
(C) It entirely prevents the incidence and infestation of all insect pests in sugarcane fields.
(D) Maximize land returns by fitting a staple cereal after ratoon harvest.

49. The 'LEISA' approach is often advocated in sustainable agriculture. What does LEISA stand for?
(A) Low External Input and Sustainable Agriculture
(B) Large Enterprise and Integrated Subsistence Agriculture
(C) Low Emission and Intensive Soil Agriculture
(D) Local Export and International Standard Agriculture

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50. Subhash Palekar is primarily associated with the promotion of which agricultural practice in India?
(A) High Yielding Varieties Programme
(B) System of Rice Intensification (SRI)
(C) Zero Budget Natural Farming (ZBNF)
(D) Precision Farming using Drones

51. A farmer owns 2 hectares of land. In Kharif, he grows Paddy on 2 ha. In Rabi, he grows Wheat on 1 ha and leaves 1 ha fallow. In Zaid, he grows Moong on 1 ha. What is his Cropping Intensity?
(A) 100%
(B) 150%
(C) 200%
(D) 250%

52. Which class of crops is most suitable for 'Dry Farming' due to their extreme drought tolerance and short duration?
(A) Sugarcane, Banana, and tropical fruit crops

(B) Paddy rice, Jute, and wetland fiber crops
(C) Plantation Tea, Coffee, and spices
(D) Millets (Pearl millet, Sorghum)

53. In an intercropping system, if the yield of the main crop is not reduced while obtaining an additional yield from the intercrop, the intercrop is known as a:
(A) Specific trap crop
(B) Supplementary crop
(C) Protective cover crop
(D) Heavy exhaustive crop

54. Which of the following bulky organic manures generally has the highest concentration of primary plant nutrients (N, P, K)?
(A) Farm Yard Manure (FYM)
(B) Municipal Compost
(C) Poultry Manure
(D) Vermicompost

55. Which of the following is NOT an advantage of an Integrated Farming System (IFS)?
(A) Efficient recycling of farm waste
(B) Steady income throughout the year
(C) Nutritional security for the farming family
(D) High dependence on external chemical inputs

56. To minimize the incidence of the 'Red Rot' disease in a severely affected sugarcane field, which agronomic intervention is highly recommended?
(A) Rotating with paddy or green manure to break the sugarcane disease cycle
(B) Cultivating the ratoon crop continuously for at least three to four consecutive years
(C) Significantly increasing the basal dose of synthetic nitrogenous fertilizers
(D) Increasing the overall frequency and volume of field irrigations during monsoon

57. 'Utera' or 'Paira' cropping practiced in some parts of India is an example of:
(A) Mixed cropping
(B) Relay cropping
(C) Ratoon cropping
(D) Alley cropping

58. In the context of natural farming, the term 'Acchadana' refers to:
(A) Deep ploughing
(B) Mulching
(C) Seed treatment
(D) Foliar spray

59. Which implement is most widely used in Northern India to sow wheat directly into combine-harvested paddy fields without prior seedbed preparation?
(A) Happy Seeder
(B) Disc Harrow
(C) Mould Board Plough
(D) Rotavator

60. In sustainable agriculture, what does the term 'Ecological Footprint' generally signify?
(A) The average physical depth and compaction created by heavy tractor tyre marks in topsoil layers.
(B) The total cumulative count of agroforestry trees planted along farm boundaries and drainage canals.
(C) Human demand on Earth's ecosystems relative to ecological regenerative capacity.
(D) The exact volumetric amount of synthetic chemical pesticide applied per square meter of field area.

61. Identify the INCORRECT statement regarding the certification process of organic products in India:
(A) NPOP certification operates strictly as a formal, accredited third-party certification mechanism.
(B) The standard mandatory conversion transition period for conventional farms to achieve organic status takes 2 to 3 years.
(C) Organic certification guarantees consumers that the final product is completely free from synthetic chemical residues.
(D) PGS-India is an international certification strictly for bulk exports to Europe.

62. A farm enterprise where crop production is combined with dairy farming, and at least 10% to 49% of the gross income is contributed by the livestock sector, is technically known as:
(A) Specialized Farming
(B) Diversified Farming
(C) Mixed Farming
(D) Capitalistic Farming

63. When green gram (Moong) is included as a summer crop between wheat harvest and paddy transplanting, what is its primary agronomic function?
(A) It eliminates the need for phosphorus application in paddy.
(B) It acts as a catch crop and provides residual

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nitrogen.
(C) It increases the soil salinity levels to suit paddy.
(D) It rapidly depletes soil moisture to facilitate dry tillage.

64. Contour bunding and terracing are physical structures primarily constructed in dry and rainfed farming areas to:
(A) Enhance micro-climatic wind velocity directly over the field surface.
(B) Prevent natural water infiltration into deeper soil sub-layers.
(C) Facilitate smooth operation of heavy commercial combine harvesters.
(D) Reduce surface runoff and conserve soil moisture.

65. Which of the following is a major agronomic advantage of substituting a cereal crop with a pulse crop in a sugarcane-based crop rotation?
(A) Improves soil physical properties and fixes nitrogen for succeeding sugarcane.
(B) It substantially increases the soil's net demand for synthetic chemical nitrogen in subsequent crops.
(C) It extracts moisture exclusively from deeper subsoil layers, thereby inducing rapid drought stress.
(D) It acts as a highly nutrient-exhaustive crop that completely eliminates all competing soil weeds.

66. 'Alley cropping' is a practice where food crops are grown in alleys formed by hedgerows of trees or shrubs. What is the primary purpose of the hedgerows?
(A) To provide sturdy structural and physical support exclusively for trailing climbing crops.
(B) To actively attract and trap destructive insect pests away from the primary cash crop.
(C) Act as windbreaks, reduce soil erosion, and supply green manure.
(D) To serve exclusively as high-value commercial timber for immediate off-farm sale.

67. Which biofertilizer is commonly used in organic farming to enhance nitrogen availability in the soil for sugarcane crops?
(A) Azotobacter
(B) Rhizobium
(C) Blue Green Algae (BGA)
(D) Frankia

68. Which of the following crop sequences represents the practice of growing four crops in a single year on the same piece of land, reflecting high land-use efficiency?
(A) Kharif Paddy - Rabi Wheat - Summer Fallow
(B) Rainfed Sorghum - Winter Chickpea (Gram)
(C) Autumn Sugarcane - First Year Ratoon
(D) Maize - Potato - Onion - Green Gram

69. Under Conservation Agriculture, 'Crop residue retention' primarily helps to:
(A) Increase soil surface temperature excessively during peak summer.
(B) Build soil organic matter and conserve moisture.
(C) Substantially increase the total evaporation loss of soil moisture.
(D) Ensure full 100% germination and emergence of all weed seeds.

70. Which of the following is a classic example of Relay Cropping widely practiced in Northern India?
(A) Sowing Wheat crop after completely harvesting and conventionally ploughing a Paddy field.
(B) Planting Potato and Sugarcane simultaneously in separate paired trenches across the field.
(C) Broadcasting Lathyrus or Linseed in standing Paddy before harvest.
(D) Growing pure sole Mustard crops systematically during the Rabi winter season.

71. To maintain soil fertility through crop rotation, all of the following rules should be followed, EXCEPT:
(A) Leguminous crops should be alternated with non-leguminous crops.
(B) Crops requiring high inputs should be followed by crops requiring fewer inputs.
(C) Fodder crops should be included in the rotation cycle.
(D) Monocot crops should always be followed continuously by monocot crops.

72. 'NICRA' is a flagship network project launched by ICAR to study and manage the impact of climate change on Indian agriculture. What does NICRA stand for?

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(A) National Initiative on Climate Resilient Agriculture
(B) National Institute for Crop Research and Agriculture
(C) National Innovation on Crop and Rainfall Adaptation
(D) Nodal Institute for Conservation and Restorative Agriculture

73. In a well-planned intercropping system, the 'Annidation' effect refers to:
(A) Extreme competition for sunlight and canopy shading leading to complete death of under-story crops.
(B) Complementary resource exploitation between crops in space or time.
(C) The active secretion of allelopathic toxic chemicals by one plant species to inhibit neighbor growth.
(D) Severe mechanical damage directly caused to one companion crop during harvesting operations of another.

74. What is the primary agronomic benefit of practicing 'Trash Mulching' in a sugarcane ratoon crop?
(A) It drastically increases the overall operational requirement of crop irrigation water.
(B) Conserves soil moisture, suppresses weeds, and adds organic matter.
(C) It aggressively promotes the rapid spread and multiplication of soil-borne fungal pathogens.
(D) It prematurely encourages unwanted early flowering and physiological maturity in ratoon crops.

75. The practice of growing two or more crops consecutively on the same field in the same calendar year is defined as:
(A) Sequential cropping
(B) Parallel intercropping
(C) Traditional mixed cropping
(D) Contour strip cropping

76. In Natural Farming, what is the primary role of 'Whapasa'?
(A) Foliar spraying of highly concentrated botanical extracts specifically designed to kill sucking aphids.
(B) Soaking and treating crop seeds with pure cow urine and herbal mixtures prior to field sowing.
(C) Creating soil air-water vapor microclimate for aeration and moisture.
(D) Constructing raised physical mud bunds and border embankments entirely around the farm field.

77. Which of the following correctly describes the interaction between crops and livestock in an Integrated Farming System?
(A) They directly compete for the same farm resources, causing severe overall financial loss.
(B) Intensive livestock rearing completely eliminates and replaces the need for crop irrigation.
(C) It continuously demands significantly higher applications of synthetic chemical fertilizers.
(D) Crop residues supply fodder, while livestock provides manure.

78. In areas with very low and erratic rainfall, which type of cropping is traditionally avoided to prevent massive crop failure?
(A) Diversified mixed cropping systems
(B) Row-arranged intercropping systems
(C) Monoculture of long-duration crops
(D) Intensive cultivation of short-duration millets

79. A farmer shifts from using solely chemical urea to a combination of Vermicompost, Azotobacter, and a reduced dose of urea. This practice is an example of:
(A) Complete and total Organic Farming system
(B) Integrated Nutrient Management (INM)
(C) High-tech site-specific Precision Farming
(D) Zero-input agro-ecological Natural Farming

80. Sugarcane being a deep-rooted, long-duration, and heavy nutrient-feeding crop, which among the following succeeding crops will ideally help rapidly restore the soil's nitrogen balance?
(A) Maize
(B) Sorghum
(C) Pearl millet
(D) Cowpea

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ANSWERS

1. (A) Deep-rooted crops should be followed by shallow-rooted crops.
Deep-rooted crops extract essential nutrients and water from deeper subsoil layers, while shallow-rooted crops primarily feed within the topsoil zone. Alternating deep-rooted crops with shallow-rooted crops prevents continuous nutrient depletion from a single soil depth. This practice maintains balanced soil structural integrity, improves overall nutrient-use efficiency, and optimizes overall moisture utilization across the entire soil profile.

2. (A) P-3, Q-2, R-4, S-1
In natural farming practices, Beejamrit serves as a bio-formulation for seed treatment to protect seeds against pathogens. Jeevamrit acts as a soil microbial culture enhancer that stimulates beneficial microflora. Acchadana refers to mulching techniques designed to conserve soil microclimate and moisture, whereas Whapasa establishes ideal soil conditions balancing aeration and moisture status for optimal plant root growth.

3. (A) They fix atmospheric nitrogen and improve soil structure.
Sugarcane is a long-duration, nutrient-exhaustive crop that depletes soil nitrogen and heavy organic matter reserves. Integrating pulse crops into sugarcane rotations adds symbiotic nitrogen-fixing Rhizobium bacteria that enrich soil nitrogen levels naturally. Furthermore, pulse root systems enhance soil aggregation, improve aeration, build organic matter, and optimize soil fertility, thereby benefiting subsequent sugarcane performance without extra inputs.

4. (C) Assertion (A) is true but Reason (R) is false.
Zero tillage significantly reduces field preparation costs and saves critical time for timely wheat sowing following paddy harvesting. However, zero tillage does not completely eliminate weed growth; in fact, weed management under zero tillage relies heavily on chemical herbicides or integrated weed management strategies. Therefore, while zero tillage saves resources, chemical or biological weed management remains necessary.

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5. (A) 750 mm
Dry farming is defined as the cultivation of crops in arid and semi-arid regions receiving an annual rainfall of less than 750 mm. In these water-scarce areas, crop production relies entirely on stored soil moisture, necessitating specialized moisture conservation practices, short-duration drought-resistant crop varieties, and efficient agronomic interventions to minimize total crop risk during dry spells.

6. (A) I and II only
Conservation Agriculture is built upon three main agronomic principles: minimal mechanical soil disturbance through zero or reduced tillage, permanent organic soil cover using crop residues or cover crops, and diversified crop rotations. Deep summer ploughing contradicts conservation principles because it severely disrupts soil structure, accelerates organic carbon oxidation, promotes wind erosion, and destabilizes active soil biological communities.

7. (D) Mustard
Autumn-planted sugarcane provides a wide row space during its initial slow growth phase in winter. Intercropping mustard takes advantage of this spatial and temporal availability without hindering sugarcane growth. Mustard matures quickly, generating early income for farmers before sugarcane enters its rapid growth phase in spring, ensuring optimal land-use efficiency and complementary crop canopy interactions.

8. (A) 2, 1, 4, 3
The National Programme for Organic Production organic certification process follows a structured procedure starting with the formal submission of an application by the farmer or group. Following submission, an accredited certification body conducts an on-site physical inspection. The official evaluation committee reviews the detailed inspection report, and upon fulfilling all standard compliance criteria, issues the official Scope Certificate.

9. (B) Relay cropping
Relay cropping is a specialized cropping pattern where a second crop is sown into the standing

primary crop before its harvest. This overlap allows the second crop to utilize residual soil moisture and early growth conditions, maximizing overall land utilization per year. It effectively saves time, reduces total tillage costs, and ensures continuous protective vegetation cover across consecutive growing seasons.

10. (B) Mixed cropping grows crops together, while mixed farming combines crop production with livestock.
Mixed cropping refers specifically to the practice of cultivating two or more crop species simultaneously on the same piece of land without distinct row arrangements. In contrast, mixed farming represents a broader agricultural production system that integrates crop cultivation with livestock rearing, poultry, or dairy, enabling internal resource recycling and lowering economic risks associated with single-enterprise farming.

11. (B) I, II and IV
Sugarcane-wheat is a prominent cropping system in Western Uttar Pradesh. Wheat sowing is often delayed due to late harvesting of ratoon sugarcane. Delayed sowing generally decreases wheat yield because of shortened vegetative periods and high temperatures during grain filling. Including a leguminous green manure crop like Dhaincha restores soil fertility, rebuilds organic matter, and enhances system sustainability.

12. (A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
Crop rotation serves as a cultural strategy to manage host-specific insect pests and pathogens. By alternating host crops with non-host plant species, pest populations are starved of their preferred primary food source, disrupting their reproduction cycle. Consequently, pest pressure decreases naturally over time, offering sustained plant protection without continuous dependence on chemical pesticide applications across consecutive crop cycles.

13. (D) It relies heavily on off-farm purchased inputs like chemical fertilizers and synthetic pesticides.
Natural farming strictly prohibits the use of synthetic chemical fertilizers, artificial growth regulators, and chemical pesticides. Instead, it relies on ecological principles, on-farm bio-formulations like Jeevamrit and Beejamrit derived from cow dung and urine, organic mulching, and natural biological processes to maintain soil health, manage pests, and promote sustainable crop growth without relying on commercial external inputs.

14. (A) P-2, Q-1, R-4, S-3
Monocropping involves growing a single crop on the same land repeatedly. Intercropping entails growing two or more crops simultaneously in distinct row patterns. Multiple cropping refers to growing multiple crops on one field within a calendar year. Ratoon cropping utilizes regrowth from stubble after crop harvest, optimizing resource use and lowering field preparation expenses for subsequent harvests.

15. (B) Mulching
In dryland agriculture, conserving limited soil water is critical for crop survival. Mulching involves covering the soil surface with organic residues, straw, plastic, or soil dust to shade the soil, lower soil surface temperature, and suppress evaporative moisture losses. This management practice preserves stored soil moisture in root zones, supporting crop development during extended dry periods.

16. (A) 1 row of sugarcane : 2 rows of potato
Autumn sugarcane is widely spaced to accommodate initial slow growth during cold winter months. Intercropping two rows of potato between single rows of sugarcane maximizes inter-row space, reduces weed growth, and optimizes sunlight exposure. This specific spatial arrangement provides supplementary revenue from potato harvest without interfering with sugarcane tillering and primary crop yield development in spring.

17. (A) Mono cropping → Double cropping → Relay cropping
Cropping intensity indicates the number of crops grown on the same field in a year. Monocropping represents the lowest intensity with only one crop per year. Double cropping increases intensity by taking two sequential crops. Relay cropping further maximizes intensity by sowing a succeeding crop into standing crops, enabling multiple crop harvests per year without field downtime.

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18. (C) Integrate agricultural enterprises to minimize risk and recycle farm waste efficiently.
The core objective of an Integrated Farming System is to combine complementary farm enterprises such as crops, livestock, poultry, and aquaculture on a single farm. This integration optimizes resource utilization, reduces production costs through byproduct recycling, stabilizes farmer income, lowers climatic or economic risks, and promotes long-term ecological and financial sustainability across farm operations.

19. (A) Enhancing the genetic mutation rate of crop seeds.
Crop rotation provides significant agronomic advantages including weed suppression, soil structure improvement, and balanced nutrient extraction from different soil layers. However, crop rotation is a field management strategy and does not induce or alter genetic mutation rates in crop seeds, which occur through natural mutagenic events or controlled plant breeding techniques in specialized biotechnology laboratories.

20. (D) Fallowing
Fallowing is the traditional practice of leaving farmland uncultivated for one or more growing seasons. This resting period allows the soil to naturally restore its organic matter reserves, replenish plant nutrient availability, accumulate subsoil moisture, and break pest and weed cycles, ultimately restoring overall soil productivity for future crop production cycles.

21. (A) I and II only
Organic farming allows external biological inputs and bulky organic manures like vermicompost and Farm Yard Manure to nourish crops. Natural farming avoids external organic additions, relying instead on local microbial concoctions like Jeevamrit and natural ecosystem processes. Neither system permits synthetic chemical fertilizers such as urea under any circumstances, adhering strictly to eco-friendly nutrition principles.

22. (A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
In dryland agriculture, crops with deep root systems penetrate lower soil strata to extract stored moisture during prolonged dry spells. Concurrently, short-duration crop varieties mature rapidly before late-season water stress occurs, effectively escaping terminal drought. Consequently, combining deep rooting traits with early maturity ensures stable crop yield performance under rainfed and water-limited conditions.

23. (D) Seed treatment to prevent seed-borne diseases and boost germination.
Beejamrit is a traditional fermented formulation composed of cow dung, cow urine, lime, and native soil used in natural farming. It is applied specifically as a seed treatment before planting. It coats seeds with beneficial microflora, protects young seedlings from seed-borne and soil-borne fungal pathogens, and enhances initial germination efficiency and root seedling vigor.

24. (A) P-2, Q-1, R-3, S-4
Legumes follow cereals to fix atmospheric nitrogen and restore soil fertility. Deep-rooted crops follow shallow-rooted crops to extract nutrients from varied soil depths. Alternating broad-leaved and narrow-leaved crops aids weed and pest management. Sowing low-water-requirement crops after high-water crops conserves soil moisture efficiently, optimizing overall water productivity across consecutive crop cycles.

25. (D) Greater than 1.0
The Land Equivalent Ratio measures the relative land area required under sole cropping to produce yields achieved in intercropping. An LER value greater than 1.0 demonstrates that intercropping produces superior total biological yield per unit land area compared to monoculture, reflecting complementary resource utilization, enhanced light interception, and reduced interspecific plant competition.

26. (B) Sustainable agriculture
Sustainable agriculture refers to farming practices designed to meet society's current food and fiber requirements without compromising the capacity of future generations to meet their own needs. It integrates environmental health, economic profitability, and social equity by conserving natural resources, minimizing synthetic chemical inputs, protecting soil vitality, and maintaining biological diversity over long-term agricultural production cycles.

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27. (B) I, II and IV
Zero tillage reduces tractor fuel consumption and associated carbon emissions by eliminating field ploughing operations. It relies on specialized planting equipment like the Happy Seeder or Zero Till Seed Drill to sow directly into field residue. Continuous zero tillage builds topsoil organic carbon over time and mitigates soil erosion, enhancing overall long-term soil structure.

28. (C) APEDA
The Agricultural and Processed Food Products Export Development Authority under the Ministry of Commerce and Industry serves as the Secretariat for implementing the National Programme for Organic Production in India. APEDA establishes accreditation standards, evaluates certifying agencies, regulates organic export products, and promotes standardized third-party organic certification systems throughout the country.

29. (D) Green Manure - Autumn Sugarcane - Ratoon - Wheat
Incorporating a green manure crop prior to autumn sugarcane establishment enriches soil organic matter and nitrogen reserves. Autumn-planted sugarcane yields higher sugar and biomass than spring crops. Following sugarcane harvest, taking a ratoon crop and concluding with wheat maximizes economic returns, maintains soil fertility, and balances nutrient extraction across the multi-year rotation sequence in Uttar Pradesh.

30. (C) Assertion (A) is true but Reason (R) is false.
Relay cropping is conceptually analogous to a relay race because the next crop is established before the primary crop finishes its growth cycle. However, the reason provided is incorrect because in true relay cropping, seeds of the succeeding crop are sown into the standing primary crop prior to harvest without performing conventional field tillage operations.

31. (B) Combining minimal inorganic fertilizers with predominantly organic manure application.
Partial organic farming is an intermediate production approach that combines reduced quantities of inorganic chemical fertilizers with substantial applications of organic manures, bio-fertilizers, and crop residues. This balanced management system reduces reliance on synthetic inputs, enhances soil physical and biological properties, maintains stable crop yield productivity, and eases transition toward full organic production systems.

32. (A) Conventional farming → In-conversion period → Fully certified organic
Achieving certified organic status requires a structured transition process. A conventional farm must first complete a mandatory in-conversion period, usually lasting two to three years depending on crop types. During this phase, synthetic chemicals are strictly prohibited, and soil chemical residues degrade before the farm can receive full organic certification under standard accredited guidelines.

33. (A) Farming system
A farming system represents a complex agro-economic organization where a farmer manages land, crops, livestock, labor, and capital inputs within a specific natural environment. It emphasizes functional interactions among integrated farm activities to maximize resource efficiency, ensure enterprise complementary relationships, reduce market risks, and sustain overall household income and long-term economic livelihood.

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34. (B) I and III only
Successful intercropping relies on species compatibility to minimize interspecific competition. Companion crops should display distinct growth habits and canopy structures to avoid light competition. Furthermore, significant differences in root architecture allow crops to draw nutrients and moisture from separate soil depths. Concurrent peak nutrient demands increase competition, making simultaneous peak resource requirements agronomic disadvantageous.

35. (B) 30%
Conservation Agriculture establishes three technical criteria, one of which is maintaining permanent organic soil cover. A minimum of 30 percent soil surface coverage by crop residues or cover crops is internationally recognized to protect soil against rain drop impact, lower evaporation, prevent water and wind erosion, and build organic matter reserves effectively.

36. (A) P-2, Q-4, R-1, S-3
Apiculture focuses on bee keeping, yielding honey while enhancing crop pollination. Vermicomposting uses earthworms to process

organic waste into nutrient-rich organic manure. Silviculture involves managing forest trees for timber, fuel, and livestock fodder. Aquaculture focuses on fish cultivation in aquatic environments, contributing high-quality protein and diversification within integrated farming operations.

37. (B) Maize
Intercropping maize with sugarcane is discouraged because maize grows rapidly, creating severe light, nutrient, and water competition for young sugarcane plants. Furthermore, maize serves as an alternative host plant for early shoot borer pests, thereby increasing pest populations, worsening infestation pressure, and significantly reducing early sugarcane tillering and ultimate stalk development.

38. (C) Minimize total crop failure risk from aberrant weather.
Dryland farmers practice mixed cropping by broadcasting seeds of diverse crops without row structure primarily as a risk management strategy. Because weather in rainfed regions is unpredictable, different crop species possess varying tolerance levels to drought or moisture stress. Mixed cropping ensures that if one crop fails, another survives, providing yield security.

39. (A) I, II and III
Jeevamrit is a microbial bio-formulation widely utilized in natural farming systems to boost soil biology. It is prepared using fresh cow dung, fresh cow urine, jaggery as a carbon source, pulse flour, and healthy undisturbed topsoil. Synthetic chemical fertilizers such as urea are completely excluded from its traditional natural preparation process.

40. (A) Growing drought-tolerant varieties and harvesting rainwater.
Climate-Resilient Agriculture focuses on adapting farming practices to climate variability and water scarcity. Utilizing drought-tolerant crop varieties alongside rainwater harvesting structures conserves crucial water resources, optimizes soil moisture usage, buffers crops against extended dry spells, and ensures stable agricultural production without depleting finite groundwater reservoirs or degrading sensitive local ecosystems.

41. (B) Growing crops susceptible to the same soil-borne diseases consecutively.
Sound agronomic crop rotation guidelines emphasize alternating crop families to interrupt disease and pest life cycles. Cultivating crops that share susceptibility to identical soil-borne pathogens in consecutive seasons leads to rapid pathogen buildup in the soil. This practice intensifies disease severity, reduces crop yields, and undermines long-term soil health and productivity.

42. (B) (Gross cropped area / Net sown area) × 100
Cropping Intensity measures the extent of land utilization over a single agricultural year. It is calculated as the ratio of Gross Cropped Area (the total area sown under all crops including multiple crops on the same land) to Net Sown Area (the actual physical land area available), multiplied by one hundred.

43. (A) Phenyl Mercuric Acetate (PMA)
Anti-transpirants are chemical compounds applied to plant foliage to minimize transpiration losses under drought conditions. Phenyl Mercuric Acetate functions as a stomata-closing anti-transpirant by inducing partial closure of leaf stomatal pores at low concentrations. This intervention decreases water loss without severely inhibiting carbon dioxide assimilation required for crop photosynthesis.

44. (B) II and III only
Fallow land management aims to restore soil fertility and prevent soil degradation. Cultivating leguminous green manure crops and plowing them under enriches soil nitrogen and organic matter. Planting cover crops protects the soil from erosion. Conversely, keeping land completely bare accompanied by repeated deep ploughing accelerates topsoil drying and wind erosion.

45. (D) Sikkim
Sikkim became the first state in India and the world to achieve full organic status, officially declared in January 2016. The state systematically phased out synthetic chemical fertilizers and pesticides, replacing them with organic inputs, natural bio-formulations, and sustainable farming practices across all its agricultural land holdings to protect ecosystem health.

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46. (C) They are healthy and produced using sustainable, chemical-free methods.
Organic agricultural produce commands higher market prices primarily because consumers value products grown without synthetic pesticides, chemical fertilizers, or genetically modified organisms. These chemical-free production methods promote health benefits and environmental sustainability. Additionally, organic certification, rigorous monitoring, and lower yields during transition periods contribute to higher production costs and premium pricing.

47. (B) Pomology - Pulse crops cultivation
Pomology is a branch of horticulture dedicated specifically to the study, cultivation, and management of fruit crops. In contrast, the cultivation of pulse crops falls under field crop agronomy. Olericulture refers to vegetable farming, floriculture involves flower cultivation, and silviculture covers forest tree management within agricultural production systems.

48. (D) Maximize land returns by fitting a staple cereal after ratoon harvest.
The sugarcane-ratoon-wheat cropping sequence is widely practiced in Northern India to optimize annual land profitability. Ratoon sugarcane matures earlier than plant sugarcane, freeing land during early winter. Sowing wheat after ratoon harvest allows farmers to cultivate a crucial staple cereal within the same field, thereby maximizing total annual farm income and cropping intensity.

49. (A) Low External Input and Sustainable Agriculture
LEISA stands for Low External Input and Sustainable Agriculture. It is an agro-ecological strategy that minimizes dependence on purchased synthetic inputs like off-farm chemical fertilizers and pesticides. Instead, LEISA emphasizes optimal utilization of internal farm resources, natural nutrient recycling, biological pest management, and ecological processes to maintain crop yields sustainably.

50. (C) Zero Budget Natural Farming (ZBNF)
Subhash Palekar is an Indian agriculturist famous for pioneering and advocating Zero Budget Natural Farming. This sustainable farming methodology emphasizes zero dependence on commercial chemical inputs or purchased organic manures. It utilizes on-farm biological formulations such as Jeevamrit and Beejamrit, accompanied by mulching and soil aeration, to lower production costs and restore soil health.

51. (C) 200%
Cropping intensity is determined by dividing Gross Cropped Area by Net Sown Area and multiplying by one hundred. Here, Net Sown Area is 2 hectares. The farmer grows 2 ha Paddy in Kharif, 1 ha Wheat in Rabi, and 1 ha Moong in Zaid, giving a Gross Cropped Area of 4 ha. Thus, (4 / 2) × 100 equals 200%.

52. (D) Millets (Pearl millet, Sorghum)
Millets such as pearl millet and sorghum possess C4 photosynthetic pathways, deep extensive root structures, and high water-use efficiency, making them exceptionally tolerant to extreme drought. They complete their growth cycles rapidly under low and erratic rainfall conditions, making them ideal choices for dryland agriculture where supplementary irrigation is unavailable.

53. (B) Supplementary crop
In an intercropping arrangement, a crop is classified as a supplementary crop when its introduction does not reduce or affect the total yield of the main crop. The supplementary crop utilizes available spatial inter-rows, light, and nutrients without causing competitive stress, thereby producing additional farm yield and optimizing land productivity.

54. (C) Poultry Manure
Among bulky organic manures, poultry manure contains higher concentrations of primary plant nutrients, particularly nitrogen, phosphorus, and potassium. Because birds excrete urine and feces together, nitrogen loss is reduced compared to other livestock manures. Consequently, poultry manure serves as a rich source of plant nutrients and organic matter for soil enrichment.

55. (D) High dependence on external chemical inputs
Integrated Farming Systems emphasize minimizing dependence on external purchased chemical inputs. Instead, IFS focuses on enterprise synergy where wastes and byproducts from one unit—such as animal manure or crop residues—serve as valuable inputs for another. This system enhances resource recycling, provides steady farm income, and ensures long-term environmental sustainability.

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56. (A) Rotating with paddy or green manure to break the sugarcane disease cycle
Red rot, caused by the fungus Colletotrichum falcatum, is a destructive soil- and seed-borne sugarcane disease. Rotating sugarcane fields with wetland paddy or leguminous green manure crops interrupts fungal host continuity. Submergence during paddy cultivation or green manure decomposition suppresses fungal spore viability in soil, effectively breaking the disease cycle.

57. (B) Relay cropping
Utera or Paira cropping is a traditional relay cropping practice popular in eastern Indian states. Seeds of pulses like chickpea, lathyrus, or lentils are broadcast directly into standing rice fields shortly before paddy harvest. This system utilizes residual soil moisture and land efficiently, saving time and tillage costs for winter crop establishment.

58. (B) Mulching
In Natural Farming principles established by Subhash Palekar, Acchadana refers to mulching. It involves covering the soil surface with organic materials like crop residues, live vegetation, or topsoil dust. Mulching conserves soil moisture, regulates surface temperature, suppresses weed germination, and fosters favorable microclimatic conditions for microbial and earthworm activity.

59. (A) Happy Seeder
The Happy Seeder is a specialized conservation agricultural machine used in Northern India to sow wheat directly into field residue. It cuts and lifts rice straw, sows wheat seed and places fertilizer into bare soil, and deposits the cut straw back as surface mulch, eliminating open stubble burning and land tillage operations.

60. (C) Human demand on Earth's ecosystems relative to ecological regenerative capacity.
In environmental science and sustainable agriculture, Ecological Footprint measures human consumption of natural resources against the Earth's biological capacity to regenerate those resources and absorb resulting wastes. It serves as an indicator to assess environmental sustainability, ecosystem stress, resource depletion, and the overall ecological footprint of agricultural activities.

61. (D) PGS-India is an international certification strictly for bulk exports to Europe.
Participatory Guarantee System for India (PGS-India) is a peer-review certification system designed specifically for domestic smallholder organic farmers within India, not for international bulk exports to European markets. Third-party accreditation under NPOP manages export certifications, whereas PGS-India provides an accessible, low-cost organic assurance framework tailored for local producers and consumers.

62. (C) Mixed Farming
Mixed farming is an agricultural system where crop production is combined with livestock rearing, with livestock contributing between 10 to 49 percent of gross farm income. This integration enhances farm resilience, allows internal recycling of crop residues as animal feed and manure as crop nutrient sources, and diversifies income streams for smallholders.

63. (B) It acts as a catch crop and provides residual nitrogen.
Cultivating green gram during the summer window between wheat harvest and paddy transplanting serves as an effective catch crop. As a leguminous plant, it fixes atmospheric nitrogen through symbiotic root nodules, enhancing soil nitrogen status. Its residue, when incorporated, improves organic matter content and soil physical conditions for the following paddy crop.

64. (D) Reduce surface runoff and conserve soil moisture.
Contour bunding and terracing are essential soil conservation structures constructed along equal elevation lines across sloped terrain in rainfed areas. These structures intercept surface runoff water, slow down water velocity, reduce topsoil erosion, and promote water infiltration into soil profiles, storing moisture for crop utilization during dry farming periods.

65. (A) Improves soil physical properties and fixes nitrogen for succeeding sugarcane.
Substituting nutrient-demanding cereal crops with leguminous pulse crops in sugarcane rotations provides major agronomic benefits. Pulses engage in symbiotic nitrogen fixation, enriching soil nitrogen reserves Naturally. Furthermore, pulse root systems loosen compacted soil layers, build soil organic carbon, enhance aggregate stability, and reduce synthetic

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fertilizer requirements for succeeding sugarcane crops.

66. (C) Act as windbreaks, reduce soil erosion, and supply green manure.
Alley cropping involves growing arable food crops between rows of woody perennial trees or shrubs. The established hedgerows serve vital functions: they act as protective windbreaks, intercept overland water flow to mitigate soil erosion, and supply prunings rich in green manure to enrich soil organic matter and nutrient content.

67. (A) Azotobacter
Azotobacter is a free-living, aerobic nitrogen-fixing bacterium widely utilized as a bio-fertilizer for non-leguminous crops like sugarcane. When applied to seed pieces or soil in organic farming systems, Azotobacter converts atmospheric nitrogen into plant-available ammonium forms, while synthesizing plant growth-promoting substances that boost sugarcane root establishment and biomass yield.

68. (D) Maize - Potato - Onion - Green Gram
The Maize-Potato-Onion-Green Gram sequence exemplifies intensive multiple cropping where four distinct crops are cultivated sequentially on the same land within a single year. This rotation leverages short-duration crop varieties and complementary growing seasons, achieving maximum land-use efficiency, high cropping intensity, and continuous economic returns throughout the entire calendar year.

69. (B) Build soil organic matter and conserve moisture.
Retaining crop residues on the soil surface is a core pillar of Conservation Agriculture. Residue mulch shields soil from extreme solar radiation and wind, reducing evaporation loss and conserving moisture. As residues decompose, they add organic carbon, improve soil aggregation, enhance water infiltration, and foster beneficial soil microbial populations.

70. (C) Broadcasting Lathyrus or Linseed in standing Paddy before harvest.
Broadcasting seeds of crops like Lathyrus or linseed into a standing paddy field prior to harvesting represents classic relay cropping, locally called Paira or Utera. The incoming crop establishes using residual soil moisture present in the rice field, saving time, preserving moisture, and avoiding field tillage operations between crop seasons.

71. (D) Monocot crops should always be followed continuously by monocot crops.
Continuous monocot cultivation violates basic crop rotation principles by encouraging specialized pest populations, encouraging host-specific diseases, and causing shallow root zone nutrient exhaustion. Sustainable rotation principles dictate alternating monocots with dicots, heavy feeders with light feeders, and leguminous crops with non-legumes to preserve biological diversity, soil structure, and long-term land fertility.

72. (A) National Initiative on Climate Resilient Agriculture
NICRA stands for National Initiative on Climate Resilient Agriculture, a flagship network project launched by the Indian Council of Agricultural Research in 2011. The project aims to enhance the resilience of Indian agriculture, livestock, and fisheries to climate variability through strategic research, technological demonstrations, capacity building, and vulnerable region adaptations.

73. (B) Complementary resource exploitation between crops in space or time.
Annidation in intercropping systems refers to ecological complementation where intercropped plant species capture solar radiation, soil nutrients, or water more effectively without severe competitive overlap. This complementary resource utilization occurs either spatially, through differing canopy heights and rooting depths, or temporally, through varying growth periods and peak resource demand timings.

74. (B) Conserves soil moisture, suppresses weeds, and adds organic matter.
Trash mulching in ratoon sugarcane involves spreading dry sugarcane leaves evenly over field inter-rows. This protective residue layer acts as an effective mulch that shades soil, curtails evaporative water loss, suppresses weed seed germination, buffers root temperatures, and gradually decomposes into humus, enriching soil organic matter and fertility.

75. (A) Sequential cropping
Sequential cropping is defined as growing two or more crops in sequence on the same field within a single calendar year. In this system,

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the succeeding crop is planted only after the preceding crop has been harvested, maintaining a distinct temporal separation without any growing overlap between the consecutive crop species.

76. (C) Creating soil air-water vapor microclimate for aeration and moisture.
In natural farming principles developed by Subhash Palekar, Whapasa represents a soil condition where both air molecules and water vapor are present in the soil pore spaces. Achieving Whapasa promotes ideal microclimatic conditions, enhances root respiration, reduces excessive irrigation demands, and stimulates beneficial soil biological activity necessary for healthy plant development.

77. (D) Crop residues supply fodder, while livestock provides manure.
In an Integrated Farming System, crops and livestock interact synergistically through circular resource recycling. Crop residues, stovers, and processing byproducts serve as nutritious fodder and feed for livestock. In return, livestock yields dung, urine, and farmyard manure, which nourish soil, replenish nutrients, build organic matter, and enhance overall crop production.

78. (C) Monoculture of long-duration crops
Cultivating long-duration crop monocultures in dryland regions with low and erratic rainfall carries high agricultural risk. Long-duration crops require extended moisture availability, making them highly susceptible to mid-season and terminal droughts. If rainfall fails during critical growth phases, entire crops fail, whereas short-duration or diversified intercropping systems provide risk mitigation.

79. (B) Integrated Nutrient Management (INM)
Integrated Nutrient Management is an agronomic approach that combines inorganic chemical fertilizers with organic manures, bio-fertilizers, and green manures to satisfy plant nutrient demands. By blending vermicompost, Azotobacter, and reduced chemical urea, this strategy optimizes nutrient availability, enhances fertilizer use efficiency, reduces soil chemical pollution, and restores long-term soil health.

80. (D) Cowpea
Sugarcane extracts heavy amounts of soil nitrogen during its long growth duration. Cowpea is a fast-growing leguminous pulse crop that forms symbiotic associations with Rhizobium bacteria, enabling atmospheric nitrogen fixation. Sowing cowpea after sugarcane harvest replenishes depleted soil nitrogen pools, supplies rich organic green manure, and restores soil fertility for subsequent crops.

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CHAPTER 05

Seed Science and Seed Treatment

1. What does 'Seed Replacement Rate' (SRR) signify in agricultural production?
(A) The percentage of total crop area sown with certified and quality seeds in a given year
(B) The percentage of total crop area sown with uncertified farm-saved seeds
(C) The rate at which weed seeds replace crop seeds in a field
(D) The percentage of non-viable seeds replaced by viable seeds during processing

2. Arrange the following classes of seed in the correct hierarchical sequence of their multiplication, from origin to commercial distribution:
I. Certified Seed
II. Foundation Seed
III. Nucleus Seed
IV. Breeder Seed
(A) III, II, IV, I
(B) IV, III, II, I
(C) III, IV, II, I
(D) IV, II, III, I

3. What is the standard colour of the tag affixed to a bag of Certified Seed?
(A) Azure Blue
(B) Golden Yellow
(C) Opal Green
(D) White

4. Which portion of the sugarcane stalk is considered most suitable for preparing seed setts for planting?
(A) The bottom one-third portion
(B) The middle portion only
(C) The top one-third to half portion
(D) Any part of the stalk provides equal germination

5. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): The top portion of the sugarcane stalk is highly preferred for seed material.
Reason (R): The top portion has younger buds and contains higher reducing sugars (glucose), which promotes rapid root and shoot sprouting.
(A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
(B) Both Assertion (A) and Reason (R) are true but R is not the correct explanation of A.
(C) Assertion (A) is true but Reason (R) is false.
(D) Assertion (A) is false but Reason (R) is true.

6. Match the classes of seed in List I with their standard tag colours in List II.
List I: (Seed Class)
P. Breeder Seed
Q. Foundation Seed
R. Registered Seed
S. Truthfully Labelled Seed
List II: (Tag Colour)
1. Purple
2. Opal Green
3. Golden Yellow
4. White
(A) P-3, Q-1, R-4, S-2
(B) P-4, Q-3, R-2, S-1
(C) P-3, Q-4, R-1, S-2
(D) P-1, Q-2, R-3, S-4

7. What is the mathematical formula used to calculate the 'Real Value' (Utility Percentage) of a seed lot?
(A) (Physical Purity % + Germination %) / 100
(B) (Germination % / Physical Purity %) x 100
(C) (Physical Purity % × Moisture %) / 100
(D) (Physical Purity % × Germination %) / 100

8. What is the primary objective of maintaining a specific isolation distance during seed production?
(A) To prevent genetic contamination through out-crossing
(B) To prevent physical seed admixture during mechanical harvesting
(C) To ensure optimal sunlight and airflow through the crop canopy
(D) To reduce the field transmission of destructive soil-borne diseases

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9. Consider the following statements regarding the 'Seed Village Scheme':
I. It aims to train farmers in scientific seed production methods.
II. It encourages the use of certified seed and increases the Seed Replacement Rate.
III. Under this scheme, the entire village must solely produce Nucleus Seed.
Which of the above statements is/are correct?
(A) I and II only
(B) II and III only
(C) I and III only
(D) I, II and III

10. What is the universally recommended safe moisture content range for storing most cereal seeds (like wheat and paddy) for one season?
(A) 4 to 6 percent
(B) 10 to 12 percent
(C) 15 to 18 percent
(D) 20 to 22 percent

11. In which year was the National Seeds Corporation (NSC) established to undertake the production of foundation and certified seeds?
(A) 1956
(B) 1963
(C) 1966
(D) 1971

12. What is the recommended number of three-budded sugarcane setts required for planting one hectare of land using the standard flat-bed method?
(A) 15,000 to 20,000 setts
(B) 35,000 to 40,000 setts
(C) 55,000 to 60,000 setts
(D) 75,000 to 80,000 setts

13. Consider the following statements about the Indian Seeds Act, 1966:
I. It applies only to notified kinds and varieties of seeds.
II. It makes seed certification mandatory for all seeds sold in India.
III. It regulates the quality of seeds sold in the market.
IV. Truthful labelling is compulsory under this Act.
Which of the above statements is/are correct?
(A) I, II and III
(B) II, III and IV
(C) I, III and IV
(D) I, II, III and IV

14. Which biological seed treatment process involves hydrating seeds in the presence of beneficial microbes to enhance disease resistance and germination?
(A) Seed scarification
(B) Seed pelleting
(C) Seed bio-priming
(D) Seed vitrification

15. The internally seed-borne disease 'Loose Smut' of wheat can be effectively controlled by treating the seeds with:
(A) Chlorpyrifos
(B) Carboxin (Vitavax)
(C) Copper Oxychloride
(D) Mancozeb

16. Select the correct sequence of procedures followed in a standard seed testing laboratory for a submitted seed sample.
(A) Mixing and Dividing → Purity Analysis → Germination Test → Moisture Test
(B) Germination Test → Moisture Test → Purity Analysis → Mixing and Dividing
(C) Purity Analysis → Germination Test → Mixing and Dividing → Moisture Test
(D) Moisture Test → Mixing and Dividing → Germination Test → Purity Analysis

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17. According to Indian Minimum Seed Certification Standards, what is the minimum required germination percentage for certified wheat seed?
(A) 75 percent
(B) 80 percent
(C) 85 percent
(D) 90 percent

18. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): When treating legume seeds, fungicide application should always precede Rhizobium culture inoculation.
Reason (R): Applying fungicide after Rhizobium inoculation can kill the beneficial bacteria present in the culture.
(A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
(B) Both Assertion (A) and Reason (R) are true but R is not the correct explanation of A.
(C) Assertion (A) is true but Reason (R) is false.
(D) Assertion (A) is false but Reason (R) is true.

19. What is the standard temperature and duration for the Moist Hot Air Treatment (MHAT) of sugarcane seed setts to eliminate seed-borne pathogens?
(A) 45°C for 1 hour
(B) 54°C for 2.5 hours
(C) 60°C for 30 minutes
(D) 70°C for 15 minutes

20. Match the seed treatment agents in List I with their primary functions in List II.
List I: (Seed Treatment Agent)
P. Thiram
Q. Imidacloprid
R. Azotobacter
S. Trichoderma viride
List II: (Primary Function)
1. Nitrogen-fixing biofertilizer
2. Systemic insecticide for pests
3. Contact fungicide for seed rot
4. Bio-fungicide for soil-borne diseases
(A) P-2, Q-3, R-4, S-1
(B) P-4, Q-1, R-2, S-3
(C) P-3, Q-4, R-1, S-2
(D) P-3, Q-2, R-1, S-4

21. The Tetrazolium Test (TZ test) is a rapid biochemical test primarily used in seed laboratories to determine:
(A) Genetic purity of the seed
(B) Seed viability
(C) Physical purity of the seed
(D) Seed moisture content

22. Consider the following statements regarding Foundation Seed:
I. It is the immediate progeny of Certified Seed.
II. Its production requires strict isolation distances to maintain genetic purity.
III. It carries a white certification tag.
Which of the above statements is/are INCORRECT?
(A) I only
(B) II only
(C) III only
(D) I and III only

23. To prevent damage from scale insects and mealy bugs, sugarcane setts are often dipped in a solution of which chemical before planting?
(A) 2,4-D
(B) Copper Sulphate
(C) Urea
(D) Malathion

24. What is the approximate seed requirement per hectare when planting potatoes using True Potato Seed (TPS)?
(A) 10-15 grams
(B) 100-150 grams
(C) 1-1.5 kilograms
(D) 10-15 kilograms

25. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): Treating sugarcane setts with Carbendazim prior to planting leads to better crop establishment.
Reason (R): Carbendazim acts as a systemic fungicide that protects the setts from primarily soil-borne and sett-borne diseases like sett rot.
(A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
(B) Both Assertion (A) and Reason (R) are true but R is not the correct explanation of A.
(C) Assertion (A) is true but Reason (R) is false.
(D) Assertion (A) is false but Reason (R) is true.

26. Which official agency is responsible for overseeing the seed certification process and issuing certification tags to seed growers in Uttar Pradesh?
(A) Indian Council of Agricultural Research (ICAR)
(B) Uttar Pradesh State Seed Certification Agency (UPSSCA)
(C) Commission for Agricultural Costs and Prices (CACP)
(D) National Bank for Agriculture and Rural Development (NABARD)

27. What is the recommended minimum isolation distance required for the production of Foundation Seed of a cross-pollinated crop like Maize?
(A) 3 meters
(B) 50 meters
(C) 200 meters
(D) 400 meters

28. What is the primary reason for removing dry trash and leaf sheaths from sugarcane stalks before preparing seed setts and treating them with chemicals?
(A) To significantly reduce the bulk weight of setts for easier field transportation

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(B) To extract supplementary residual sugars present in the dried leaf sheaths
(C) To expose buds and root primordia for improved chemical uptake and sprouting
(D) To utilize the stripped leaf material exclusively as nutrient-rich livestock forage

29. Consider the following statements regarding conditions for an ideal seed storage house (godown):
I. It should be damp-proof and well-ventilated.
II. The relative humidity inside should be kept as high as possible.
III. It must be protected from rodents and birds.
IV. Temperature fluctuations should be minimised.
Which of the above statements is/are correct?
(A) I, II and III
(B) I, III and IV
(C) II, III and IV
(D) I, II, III and IV

30. For safe, long-term storage without losing viability, the moisture content of oilseeds like mustard and groundnut should be reduced to:
(A) 6 to 8 percent
(B) 12 to 14 percent
(C) 16 to 18 percent
(D) 20 to 22 percent

31. In seed quality control, what is the primary objective of conducting a 'Grow-Out Test' (GOT) in the field?
(A) To evaluate seed germination percentage
(B) To assess the genetic purity of the seed lot
(C) To determine the physical purity of the seed lot
(D) To check the moisture content of the seeds

32. Select the correct standard sequence for multiple seed treatments (the FIR method) applied to leguminous crops before sowing.
(A) Insecticide → Fungicide → Rhizobium culture
(B) Fungicide → Insecticide → Rhizobium culture
(C) Rhizobium culture → Fungicide → Insecticide
(D) Insecticide → Rhizobium culture → Fungicide

33. Which of the following insecticides is most commonly applied in the furrows during sugarcane planting to protect the setts from termite attacks?
(A) Chlorpyrifos
(B) Dichlorvos
(C) Mancozeb
(D) Pendimethalin

34. Match the crops in List I with their required minimum isolation distance for Foundation Seed production in List II.
List I: (Crop)
P. Wheat
Q. Cotton
R. Mustard
S. Maize
List II: (Isolation Distance)
1. 50 meters
2. 3 meters
3. 400 meters
4. 100 meters
(A) P-3, Q-4, R-1, S-2
(B) P-2, Q-4, R-1, S-3
(C) P-2, Q-1, R-4, S-3
(D) P-1, Q-2, R-3, S-4

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35. Which specific class of seed generation is generally omitted in the commercial Indian seed certification system?
(A) Registered Seed
(B) Breeder Seed
(C) Foundation Seed
(D) Certified Seed

36. Consider the following statements regarding hybrid seed production in maize:
I. Detasseling is the process of removing male flowers (tassels) from the female parent line.
II. Detasseling prevents self-pollination in the female parent line.
III. The male and female parent lines are sown in a specific row ratio (e.g., 2:6 or 2:4).
Which of the above statements is/are correct?
(A) I and II only
(B) I and III only
(C) II and III only
(D) I, II and III

37. The National Seed Research and Training Centre (NSRTC), an apex centre for seed testing and quality control under the Government of India, is located in which district of Uttar Pradesh?
(A) Lucknow
(B) Varanasi
(C) Kanpur

(D) Meerut

38. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): Seed certification is a voluntary process for farmers and seed companies in India.
Reason (R): Under the Seeds Act, 1966, truthful labelling of seed containers is compulsory for notified kinds and varieties.
(A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
(B) Both Assertion (A) and Reason (R) are true but R is not the correct explanation of A.
(C) Assertion (A) is true but Reason (R) is false.
(D) Assertion (A) is false but Reason (R) is true.

39. Which plant growth hormone, highly concentrated in the apical buds of a sugarcane stalk, promotes faster initial sprouting when top setts are used for planting?
(A) Abscisic acid
(B) Ethylene
(C) Jasmonic acid
(D) Auxin

40. What is the general minimum standard for the physical purity of certified seed for most agricultural crops (like wheat and paddy) in India?
(A) 90 percent
(B) 95 percent
(C) 98 percent
(D) 100 percent

41. Which of the following is a bio-agent widely used as a biological seed treatment to protect seeds and seedlings against soil-borne diseases like wilt and root rot?
(A) Bacillus thuringiensis
(B) Trichoderma viride
(C) Acetobacter diazotrophicus
(D) Beauveria bassiana

42. Consider the following statements regarding the benefits provided to farmers under various Seed Subsidy Schemes in Uttar Pradesh:
I. Subsidies are provided to reduce the cost burden of purchasing high-quality certified seeds.
II. Subsidies are credited directly to the farmer's bank account through DBT (Direct Benefit Transfer).
III. The schemes completely replace all farm-saved seeds with free government seeds.
IV. They promote the timely availability of new disease-resistant varieties.
Which of the above statements is/are INCORRECT?
(A) I and II
(B) III only
(C) II and IV
(D) I and IV

43. Why are three-budded setts generally preferred over single-budded setts for commercial flat-bed planting of sugarcane?
(A) They ensure higher survival as middle buds are protected against moisture loss
(B) They significantly reduce manual labor hours required during sett cutting
(C) They completely eliminate the necessity of pre-sowing chemical seed treatment
(D) They effectively protect emerging shoots from top borer attack during tillering

44. Historically, organomercurial compounds like Agallol and Aretan were extensively used for sugarcane sett treatment. What was their primary mode of action?
(A) Herbicides
(B) Nematicides
(C) Fungicides
(D) Rodenticides

45. In seed science, how is the 'Physical Purity' of a seed sample defined?
(A) The percentage of seeds that successfully germinate under controlled laboratory conditions
(B) The total percentage of moisture retained within the outer seed coat tissues
(C) The percentage of genetically uniform and identical seeds present in the lot
(D) The percentage by weight of pure seed of the declared species in a sample

46. Match the regulatory milestones in Indian seed science in List I with their respective years in List II.
List I: (Regulatory Milestone)
P. Establishment of NSC
Q. Enactment of Seeds Act
R. Notification of Seeds Rules
S. Seeds (Control) Order
List II: (Year)
1. 1968
2. 1966

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3. 1983
4. 1963

(A) P-2, Q-4, R-3, S-1
(B) P-4, Q-1, R-2, S-3
(C) P-4, Q-2, R-1, S-3
(D) P-1, Q-2, R-4, S-3

47. The technique of soaking seeds in water or a dilute salt solution to initiate the pre-germinative metabolic processes without actual radicle emergence is known as:
(A) Seed pelleting
(B) Seed priming
(C) Seed scarification
(D) Seed stratification

48. Which class of seed is produced directly under the supervision of the plant breeder or the sponsoring agricultural institution that developed the variety?
(A) Certified Seed
(B) Foundation Seed
(C) Registered Seed
(D) Breeder Seed

49. Grassy Shoot Disease (GSD) in sugarcane, which results in profuse tillering and stunted growth, is primarily transmitted through infected seed setts. What is the causal organism of GSD?
(A) Phytoplasma
(B) Fungus
(C) Virus
(D) Nematode

50. Consider the following statements about seed labels and tags:
I. Truthfully Labelled Seed bags carry an opal green tag.
II. The dimensions of a Certified Seed tag are standard at 15 cm × 7.5 cm.
III. Breeder seed is tagged with a golden yellow label.
Which of the above statements is/are correct?
(A) I and II only
(B) II and III only
(C) I and III only
(D) I, II and III

51. What is the mandated dimension of the certification tag attached to a bag of Certified Seed?
(A) 10 cm × 5 cm
(B) 15 cm × 7.5 cm
(C) 20 cm × 10 cm
(D) 25 cm × 15 cm

52. In a seed testing laboratory, the actual 'Working Sample' on which purity analysis is conducted is derived by mechanically dividing the:
(A) Primary sample
(B) Composite sample
(C) Moisture sample
(D) Submitted sample

53. Compared to true botanical seeds, what is the primary genetic advantage of using vegetative propagating material like sugarcane setts for commercial farming?
(A) Vegetative propagation material is inherently free from all seed-borne pathogen infections
(B) Vegetative reproduction ensures complete genetic uniformity (clonal purity) of the crop
(C) Vegetative planting material possesses a significantly longer shelf life than true botanical seeds
(D) Vegetative material requires no post-planting field irrigation under standard conditions

54. Under normal conditions, what is the maximum validity period of the seed certification tag from the date of the seed testing?
(A) 3 months
(B) 6 months
(C) 9 months
(D) 24 months

55. What term is used for seeds that meet physical purity and germination standards and are sold by producers with their own quality declaration, but are not certified by an official agency?
(A) Nucleus Seed
(B) Breeder Seed
(C) Sub-standard Seed
(D) Truthfully Labelled Seed

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56. A high Seed Replacement Rate (SRR) in a particular district implies that:
(A) Farmers regularly purchase certified seeds from reliable external sources
(B) Farmers rely predominantly on their uncertified farm-saved seeds for seasonal sowing
(C) The overall quality and post-harvest market value of agricultural produce is declining
(D) The inherent soil fertility and nutrient status of the district has severely degraded

57. What is the standard recommended method for treating sugarcane setts with liquid biofertilizers like Azotobacter and PSB before planting?
(A) Dusting dry, un-soaked setts thoroughly with fine biofertilizer powder before planting
(B) Dipping setts in an aqueous biofertilizer solution for 30 minutes
(C) Injecting the concentrated liquid biofertilizer directly into individual sugarcane buds
(D) Spraying the biofertilizer formulation on the standing crop canopy 30 days after planting

58. Which chemical is most commonly recommended for the fumigation of seed godowns to control storage grain pests without harming seed viability?
(A) Methyl parathion
(B) Aluminium phosphide
(C) Copper sulphate
(D) Carbaryl

59. According to Harrington's thumb rule of seed storage, the storage life of a seed is halved for every:
(A) 1% increase in seed moisture or 5°C increase in storage temperature
(B) 5% increase in seed moisture or 1°C increase in storage temperature
(C) 10% increase in seed moisture or 10°C increase in storage temperature
(D) 2% decrease in seed moisture or 5°C decrease in storage temperature

60. The most devastating disease of sugarcane in Uttar Pradesh, commonly known as the "cancer of sugarcane," which is frequently transmitted via infected seed setts is:
(A) Smut
(B) Wilt
(C) Red Rot
(D) Pokkah Boeng

61. The tag of which seed class is characterised by a Golden Yellow colour and carries a diagonal signature of the producing scientist?
(A) Certified Seed
(B) Foundation Seed
(C) Truthfully Labelled Seed
(D) Breeder Seed

62. What is the standard isolation distance required for certified seed production of self-pollinated crops like wheat and paddy?
(A) 3 meters
(B) 25 meters
(C) 100 meters
(D) 200 meters

63. During the preparation of sugarcane setts, what happens if the sharp cutting knife is continuously used without sterilization between different cane stalks?
(A) It causes the nodal sugarcane buds to lose internal moisture very rapidly after cutting
(B) It transmits Ratoon Stunting Disease (RSD) mechanically between setts
(C) It inflicts severe mechanical damage to the delicate root primordia around the node
(D) It artificially increases the sucrose accumulation within lower cane internodes

64. The Central Seed Committee (CSC), which advises the Central and State Governments on matters arising out of the administration of the Seeds Act, was established under which section of the Seeds Act, 1966?
(A) Section 3
(B) Section 5
(C) Section 7
(D) Section 9

65. Which of the following seed classes possesses 100% genetic and physical purity and forms the basis for all further seed multiplication?
(A) Nucleus Seed
(B) Foundation Seed
(C) Registered Seed
(D) Certified Seed

66. In the context of sugarcane planting techniques, what does the 'STP' method stand for?
(A) Standard Translocation Procedure
(B) Sugarcane Trench Planting
(C) Spaced Transplanting Technique
(D) Seed Treatment Protocol

67. What is the primary function of mechanical seed scarification?
(A) To break hard seed coat dormancy, allowing water permeability
(B) To rapidly reduce seed moisture content prior to high-humidity storage
(C) To coat the seed surface uniformly with chemical protective fungicides
(D) To separate unwanted weed seeds efficiently from the primary crop seed lot

68. In Uttar Pradesh, the distribution of subsidised certified seeds and agrochemicals at the block

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level is predominantly executed through which government centres?
(A) Block-level Primary Health and Sanitation Centres
(B) Local Agricultural Produce Market Committee (Mandi Parishad) Outlets
(C) Regional Sugarcane Research and Development Stations
(D) Krishi Raksha Ikaies / Government Seed Stores

69. The beneficial bacteria Pseudomonas fluorescens is primarily used in seed treatment for its high efficacy against:
(A) Common destructive insect pests of stored agricultural grains
(B) Bacterial blights and soil-borne wilts
(C) Early shoot borers and top borers in sugarcane fields
(D) Rodent populations causing physical damage in seed godowns

70. When treating sugarcane setts in a fungicidal solution (e.g., Carbendazim) before planting, what is the standard recommended soaking time to ensure adequate chemical uptake?
(A) 1 to 2 minutes
(B) 15 to 30 minutes
(C) 4 to 6 hours
(D) 12 to 24 hours

71. During a physical purity analysis in a seed testing laboratory, which of the following is classified strictly as 'Inert Matter'?
(A) Viable and non-viable seeds belonging to other cultivated crop species
(B) Seeds of noxious and objectionable weed species present in the sample
(C) Genetically off-type or variant seeds belonging to the same crop species
(D) Sand, stones, chaff, and seed fragments under half size

72. For long-term conservation in a national gene bank, orthodox seeds are typically dried to a moisture content of 5-7% and stored at a temperature of:
(A) 10°C
(B) 0°C
(C) -18°C
(D) -196°C

73. To effectively prevent the transmission of Ratoon Stunting Disease (RSD) through sett-cutting knives, the implements should be sterilised by wiping or dipping them in:
(A) Standard cold tap water wash
(B) 5% Lysol or Formalin solution
(C) Dilute 2% aqueous Urea solution
(D) Dry powdered Carbaryl formulation

74. What is a key focus of the 'Seed Village Scheme' promoted by the government?
(A) Promoting and exporting high-value agricultural seeds to foreign international markets
(B) Upgrading farm-saved seed quality through local farmer training
(C) Enforcing a complete ban on private seed company sales in designated rural districts
(D) Converting fertile agricultural farmland into permanent state-protected forest reserves

75. In the context of systematic seed production, what does the term 'Roguing' refer to?
(A) Removing off-types and diseased plants from the seed plot
(B) Applying pre-emergence chemical herbicides prior to crop seedling emergence
(C) Mechanically threshing, cleaning, and grading the harvested crop seed lot
(D) Physically counting germinated seeds at regular intervals during a laboratory test

76. Which of the following is a major primary storage pest of wheat seeds, the damage of which is primarily controlled by keeping seed moisture content below 10%?
(A) Helicoverpa armigera (Gram pod borer)
(B) Chilo partellus (Stem borer)
(C) Sitophilus oryzae (Rice weevil)
(D) Spodoptera litura (Tobacco caterpillar)

NODIA

77. The advanced "Ring Pit" method of sugarcane planting, designed for high yields, involves the strategic placement of which specific type of seed material?
(A) Plantings composed of entire un-cut mature sugarcane stalks
(B) Young seedlings raised exclusively from true botanical seeds
(C) Micro-propagated plantlets derived from apical meristem tissue cultures
(D) Two-budded setts placed circularly in deep pits

78. Why does Breeder Seed NOT fall under the standard inspection purview of the State Seed Certification Agency?
(A) Because it possesses inherently low genetic purity that fails standard field inspection criteria
(B) Because national seed laws strictly prohibit the commercial production of Breeder Seed in India
(C) It is monitored directly by the plant breeder, requiring no state certification
(D) Because all breeder seed stock is imported exclusively from foreign agricultural research centers

79. A farmer in Uttar Pradesh purchases a sealed seed bag bearing a conspicuous fluorescent Green tag. What category of seed has the farmer purchased?
(A) Certified Foundation Seed
(B) Truthfully Labelled Seed
(C) Official Breeder Seed
(D) Certified Seed (Class I)

80. In comprehensive seed quality control, what is the specific purpose of conducting an 'ODV' test?
(A) To measure the Optimum Dry Volume of seeds before entering storage
(B) To calculate the Overall Disease Vulnerability index of the seedling
(C) To estimate the Oxygen Demand Value required during active germination
(D) To identify Other Distinguishable Varieties present in the seed lot

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ANSWERS

1. (A) The percentage of total crop area sown with certified and quality seeds in a given year
Seed Replacement Rate measures the percentage of total cropped area sown with certified or quality seeds relative to total sown area. Maintaining an optimum replacement rate ensures that farmers utilize genetically pure, high-yielding, and disease-free planting material rather than degraded farm-saved seeds, thereby significantly enhancing overall crop productivity, food security, and farm income levels across agricultural regions.

2. (C) III, IV, II, I
Seed multiplication follows a strict hierarchical sequence to ensure genetic purity across generations. The process originates from Nucleus Seed maintained by the originating plant breeder, which is multiplied into Breeder Seed. Breeder Seed is then multiplied into Foundation Seed, which finally yields Certified Seed distributed directly to farmers for commercial crop cultivation.

3. (A) Azure Blue
Certified Seed bags carry a standard Azure Blue colored tag issued by accredited State Seed Certification Agencies. This blue tag serves as an official certification guarantee indicating that the enclosed seed lot meets prescribed minimum physical purity, genetic purity, germinability, and moisture content standards established under national seed regulatory acts for commercial cultivation.

4. (C) The top one-third to half portion
The top one-third to half portion of a mature sugarcane stalk provides the most suitable seed setts for planting. This upper region contains young, actively metabolic vegetative buds and high concentrations of reducing sugars like glucose. These physiological characteristics promote rapid root initiation, uniform bud sprouting, higher germination rates, and vigorous early crop establishment.

5. (A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
The top portion of a sugarcane stalk is highly preferred as seed material because it possesses young, physiologically active buds. Furthermore, this section contains higher proportions of reducing sugars, such as glucose and fructose, alongside higher moisture content, which together provide immediate metabolic energy and hydration required for rapid, uniform root sprouting and shoot emergence in fields.

6. (C) P-3, Q-4, R-1, S-2
Seed classes are distinguished by official color-coded certification tags attached to containers. Breeder Seed receives a Golden Yellow tag signed by the breeder. Foundation Seed is tagged with a White label. Registered Seed carries a Purple tag, while Truthfully Labelled Seed is marked with an Opal Green tag, enabling clear field identification and quality assurance during agricultural trade.

7. (D) (Physical Purity % × Germination %) / 100
The Real Value or Utility Percentage of a seed lot reflects the actual field usefulness of the seed batch. It is calculated mathematically by multiplying the Physical Purity Percentage by the Germination Percentage and dividing the product by one hundred. This metric determines the precise seed rate required to achieve optimum plant population in agricultural fields.

8. (A) To prevent genetic contamination through out-crossing
Isolation distance is the physical separation maintained between a seed production field and adjacent fields containing potential contaminating crops. Its primary objective is to prevent unwanted cross-pollination and genetic contamination from foreign pollen sources, thereby maintaining the strict varietal purity and original genetic characteristics of the certified seed crop throughout its reproduction cycles.

9. (A) I and II only
The Seed Village Scheme focuses on upgrading the quality of farm-saved seeds and training farmers in scientific seed production technologies.

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By encouraging the decentralized production and distribution of high-quality certified seeds within farming communities, it effectively increases the Seed Replacement Rate. However, nucleus seed production is not conducted by entire villages as it requires strict breeder supervision.

10. (B) 10 to 12 percent
Storing cereal seeds like wheat and paddy at ten to twelve percent moisture content ensures long-term viability during seasonal storage under ambient conditions. Maintaining moisture within this range minimizes seed respiration, prevents heating, suppresses fungal growth, and inhibits storage pest activity, while preventing desiccation damage that occurs if seeds are excessively dried below critical physiological thresholds.

11. (B) 1963
The National Seeds Corporation was established in March 1963 as a premier Public Sector Undertaking under the Ministry of Agriculture. Its primary mandate involves producing foundation and certified seeds of high genetic quality, organizing systematic seed production programs across India, establishing quality standards, and modernizing the seed industry infrastructure to support national food security.

12. (B) 35,000 to 40,000 setts
Planting sugarcane using the standard flat-bed method requires approximately 35,000 to 40,000 three-budded setts per hectare at standard row spacing of 75 to 90 centimeters. This quantity ensures an adequate population of primary shoots, resulting in optimum stalk density, robust tiller formation, and maximum cane yield without excessive competition for nutrients and solar radiation.

13. (C) I, III and IV
The Indian Seeds Act of 1966 provides a regulatory framework to control seed quality sold across the country. It applies specifically to notified kinds and varieties, making truthful labelling compulsory for commercial sales. While it regulates quality parameters like purity and germination, seed certification remains voluntary rather than mandatory for seed producers and marketers.

14. (C) Seed bio-priming
Seed bio-priming is an advanced seed treatment technique combining controlled hydration with biological agents like beneficial bacteria or fungi. Seeds are partially hydrated to trigger early metabolic activities while simultaneously colonizing the seed coat with bio-agents. This integrated process enhances germination speed, improves crop uniformity, and provides effective early protection against soil-borne and seed-borne plant pathogens.

15. (B) Carboxin (Vitavax)
Loose smut of wheat is an internally seed-borne fungal disease caused by Ustilago segatum var. tritici, where dormant mycelium resides inside the seed embryo. Treating seeds with systemic fungicides like Carboxin, commercially known as Vitavax, effectively penetrates the seed coat to eliminate internal mycelial infections without harming embryo viability or reducing seedling vigor.

16. (A) Mixing and Dividing → Purity Analysis → Germination Test → Moisture Test
Standard operating protocol in a certified seed testing laboratory requires mixing and dividing the submitted sample first to obtain a uniform working sample. Next, physical purity analysis is conducted to separate pure seed from inert matter and other crop seeds. Germination tests are then performed on pure seeds, followed by official moisture content determination.

17. (C) 85 percent
According to Indian Minimum Seed Certification Standards, certified wheat seed must maintain a minimum germination capacity of eighty-five percent. This rigorous benchmark guarantees that distributed seed lots possess high physiological viability and field emergence potential, ensuring uniform stand establishment, robust seedling establishment, and optimal crop productivity under standard field cultivation conditions across farming regions.

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18. (A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
Fungicide application must always precede Rhizobium culture inoculation when treating leguminous seeds before sowing. Applying fungicides directly after inoculating with beneficial Rhizobium bacteria can kill or severely inhibit these sensitive nitrogen-fixing bacterial populations. Following the correct sequence ensures effective fungal pathogen protection

while preserving viable Rhizobium bacteria for root nodulation and nitrogen fixation.

19. (B) 54°C for 2.5 hours
Moist Hot Air Treatment of sugarcane setts at fifty-four degrees Celsius for two and a half hours at relative humidity above ninety-five percent effectively eliminates systemic seed-borne pathogens. This thermal therapy eradicates causal organisms responsible for destructive diseases such as Grassy Shoot Disease, Ratoon Stunting Disease, and Red Rot without damaging vegetative bud viability.

20. (D) P-3, Q-2, R-1, S-4
Seed treatment chemicals and biological agents fulfill specialized functions in crop protection. Thiram operates as a protective contact fungicide against seed rot fungi. Imidacloprid provides systemic insecticidal protection against sucking pests. Azotobacter acts as a free-living nitrogen-fixing biofertilizer, whereas Trichoderma viride serves as a potent bio-fungicide against soil-borne plant pathogens during early seedling establishment.

21. (B) Seed viability
The Tetrazolium Test is a rapid biochemical assay used to evaluate seed viability by assessing respiratory enzyme activity in living seed tissues. Living tissues contain dehydrogenase enzymes that reduce colourless 2,3,5-triphenyl tetrazolium chloride into a bright red, insoluble compound called formazan, enabling analysts to distinguish viable tissues from dead, non-respiring embryonic seed tissues within hours.

22. (A) I only
Foundation Seed is the immediate progeny of Breeder Seed, not Certified Seed, and is produced under strict scientific supervision to maintain high genetic purity. It requires specified isolation distances to prevent contamination and carries a standard white certification tag issued by state certification agencies. Certified seed is subsequently produced from foundation seed stock for distribution.

23. (D) Malathion
Sugarcane setts are frequently dipped in an insecticidal solution containing Malathion or Chlorpyrifos prior to field planting to safeguard against scale insects, mealybugs, and soil insect pests. Scale insects and mealybugs shelter beneath protective sheaths on setts, feeding on sap and impeding bud sprouting unless chemical dipping effectively neutralizes them before soil insertion.

24. (B) 100-150 grams
True Potato Seed requires approximately one hundred to one hundred fifty grams of seeds per hectare for raising seedlings in nursery beds or field planting. In contrast to traditional vegetative seed tubers that require two to three tonnes per hectare, TPS offers a cost-effective, disease-free, and easy-to-transport alternative for commercial potato production systems globally.

25. (A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
Treating sugarcane setts with Carbendazim before planting promotes superior crop establishment because Carbendazim functions as an effective systemic fungicide. It penetrates setts to protect emerging shoots and nodal roots from destructive seed-borne and soil-borne fungal diseases like sett rot and pineapple disease, thereby ensuring high germination rates, healthy shoot growth, and optimal stand density in fields.

26. (B) Uttar Pradesh State Seed Certification Agency (UPSSCA)
The Uttar Pradesh State Seed Certification Agency is the authorized autonomous statutory organization responsible for enforcing seed certification standards in Uttar Pradesh. It conducts field inspections, monitors seed crop production, performs laboratory quality testing, and issues official certification tags to verified seed lots, ensuring farmers receive high-quality certified seeds complying with legal standards.

27. (D) 400 meters
Foundation seed production of cross-pollinated crops like maize requires a minimum isolation distance of four hundred meters from adjacent maize fields containing different varieties or off-type plants. This wide separation prevents wind-borne foreign pollen from fertilizing female plants, maintaining absolute genetic purity, varietal characteristics, and hybrid integrity throughout the commercial seed production cycle.

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28. (C) To expose buds and root primordia for improved chemical uptake and sprouting
Removing dry trash and leaf sheaths from sugarcane stalks prior to preparing setts exposes hidden vegetative buds and root primordia. Eliminating this physical barrier allows chemical fungicides, insecticides, and bio-fertilizers to directly contact and coat vital bud tissues, thereby enhancing chemical absorption, preventing localized pest harboring, and accelerating uniform root sprouting and shoot emergence.

29. (B) I, III and IV
An ideal seed storage facility must be damp-proof, well-ventilated, and protected against rodents, birds, and insects, while minimizing temperature fluctuations. Maintaining high relative humidity inside godowns is highly undesirable, as elevated humidity increases seed equilibrium moisture content, causing accelerated seed deterioration, fungal proliferation, loss of germination power, and rapid pest infestation during storage periods.

30. (A) 6 to 8 percent
Oilseed crops like mustard and groundnut possess high lipid content, making them highly susceptible to enzymatic degradation and auto-oxidation during storage. Reducing moisture levels to six to eight percent prior to long-term storage suppresses lipase activity, minimizes hydrolytic rancidity, prevents fungal spoilage, and preserves embryo viability without compromising seed quality over extended periods.

31. (B) To assess the genetic purity of the seed lot
A Grow-Out Test is a mandatory field trial conducted to determine the genetic purity of a seed lot. Seed samples are grown to maturity alongside authentic control samples under field conditions, allowing inspectors to examine distinct morphological characteristics, identify varietal off-types, and confirm whether the lot meets prescribed genetic purity standards before commercial release.

32. (B) Fungicide → Insecticide → Rhizobium culture
When applying multiple seed treatments to leguminous crops, the correct sequence is Fungicide first, followed by Insecticide, and finally Rhizobium bio-fertilizer inoculation (FIR method). Applying protective chemicals first creates a defensive barrier against diseases and insects without directly exposing beneficial Rhizobium bacteria to concentrated chemical fungicides that could destroy nitrogen-fixing bacterial populations.

33. (A) Chlorpyrifos
Chlorpyrifos is an effective organophosphate insecticide commonly applied directly into planting furrows during sugarcane planting to protect setts against severe termite attack. Termites consume sett tissues, damaging buds and preventing sprouting. Soil application of Chlorpyrifos creates a protective chemical barrier, ensuring high sett survival, healthy root development, and uniform crop establishment.

34. (C) P-2, Q-1, R-4, S-3
Isolation distances vary according to crop pollination mechanisms during seed production. Self-pollinated wheat requires three meters, while cross-pollinated maize needs four hundred meters for foundation seed. Cotton, being often cross-pollinated, requires fifty meters, whereas cross-pollinated mustard requires one hundred meters to prevent cross-contamination by insect or wind pollen, ensuring required genetic purity standards.

35. (A) Registered Seed
Registered Seed is a seed generation class positioned between Foundation Seed and Certified Seed that is generally omitted in the standard Indian seed certification system. In India, Certified Seed is produced directly from Foundation Seed to streamline the seed multiplication chain, reduce administrative complexity, and accelerate the distribution of high-quality seeds to farming communities.

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36. (D) I, II and III
Hybrid maize seed production relies on detasseling, which involves physically removing male inflorescences (tassels) from female parent lines before pollen shed. This practice prevents self-pollination in female plants, ensuring outcrossing exclusively with pollen from inter-planted male parent rows. Maintaining specific female-to-male row ratios ensures efficient pollination, optimal seed set, and high hybrid seed purity.

37. (B) Varanasi
The National Seed Research and Training Centre is located in Varanasi, Uttar Pradesh, serving as

an apex national institute under the Ministry of Agriculture. It serves as a central referral laboratory for seed testing, conducts advanced research on seed science, and delivers specialized training programs to technical personnel to harmonize seed testing procedures nationwide.

38. (B) Both Assertion (A) and Reason (R) are true but R is not the correct explanation of A.
Seed certification in India is a voluntary service available to seed growers, whereas truthful labelling is mandatory under the Seeds Act of 1966 for all notified crop varieties sold commercially. Both statements are factually accurate, but the compulsory nature of truthful labelling is an independent statutory requirement rather than an explanation for voluntary seed certification.

39. (D) Auxin
Auxin is a vital plant growth hormone heavily concentrated in the apical meristems and top buds of sugarcane stalks. When top setts are used for planting material, high auxin levels stimulate active cell division, apical dominance release upon cutting, and rapid initial shoot emergence, resulting in faster root sprouting and uniform early crop establishment in fields.

40. (C) 98 percent
The minimum physical purity standard for certified seeds of most agricultural crops, such as wheat and paddy, is ninety-eight percent in India. This strict standard ensures that commercial seed lots consist almost entirely of intact seeds of the designated crop species, containing minimal inert matter, chaff, broken seeds, or weed seeds that impair field performance.

41. (B) Trichoderma viride
Trichoderma viride is a beneficial bio-control fungus widely utilized for biological seed treatment against soil-borne fungal pathogens causing wilt, root rot, and damping-off diseases. Upon seed application, Trichoderma rapidly colonizes root systems, secretes lytic enzymes, competes for nutrients, and parasitizes pathogenic fungi, providing eco-friendly disease protection and enhancing overall seedling establishment and vigor.

42. (B) III only
Seed subsidy schemes in Uttar Pradesh aim to make certified seeds accessible and affordable for farmers, enhancing the Seed Replacement Rate. Subsidies are transferred directly to farmers through Direct Benefit Transfer. These schemes do not completely replace farm-saved seeds with free government seeds, but rather provide financial support to encourage voluntary adoption of improved certified crop varieties.

43. (A) They ensure higher survival as middle buds are protected against moisture loss
Three-budded setts are preferred for flat-bed sugarcane planting because the central bud remains protected between two internodes. This physical structure buffers internal moisture loss and provides metabolic reserves, ensuring high bud survival even under adverse soil moisture conditions. Single-budded setts desiccation-risk rapidly, while three-budded setts provide dependable shoot emergence and healthy stand density in fields.

44. (C) Fungicides
Organomercurial compounds, including trade formulations like Agallol and Aretan, were historically used as potent contact fungicides for treating sugarcane setts. They effectively eliminated sett-borne fungal pathogens responsible for sett rot and pineapple disease during germination. However, their use has been phased out due to toxic environmental persistence and heavy metal bioaccumulation concerns in ecosystems.

45. (D) The percentage by weight of pure seed of the declared species in a sample
Physical Purity in seed science defines the composition of a seed sample expressed as a percentage by weight of pure seeds of the declared crop species. It measures freedom from physical contaminants, including inert matter like soil and chaff, damaged seed fragments below half size, seeds of other crop species, and undesirable weed seeds present within the sample.

46. (C) P-4, Q-2, R-1, S-3
Key regulatory milestones in Indian seed sector history include the establishment of the National Seeds Corporation in 1963, enactment of the landmark Seeds Act in 1966, notification of the official Seeds Rules in 1968, and promulgation of the Seeds Control Order in 1983 to regulate seed distribution, commercial quality, and fair trade practices nationwide.

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47. (B) Seed priming
Seed priming is a controlled hydration technique where seeds are soaked in water or osmotic solutions to trigger pre-germinative metabolic processes without permitting radicle emergence. Upon re-drying and sowing, primed seeds exhibit synchronized, rapid germination, improved seedling vigor, superior root growth, and enhanced tolerance against environmental stresses like drought and salinity during crop establishment.

48. (D) Breeder Seed
Breeder Seed is the direct progeny of Nucleus Seed and is produced under the direct personal supervision of the plant breeder or sponsoring agricultural research institution. It possesses exceptionally high genetic and physical purity standards, serving as the primary source material for producing Foundation Seed within national seed multiplication and certification programs across agricultural systems.

49. (A) Phytoplasma
Grassy Shoot Disease in sugarcane is caused by a Phytoplasma pathogen and is primarily transmitted through infected vegetative seed setts or sap-sucking insect vectors. The disease leads to severe stunting, thin chlorotic leaves, excessive proliferation of tillers giving a grassy appearance, and drastic losses in cane yield, requiring disease-free planting material or thermal sett treatment for control.

50. (D) I, II and III
Seed packaging regulations mandate specific color-coded identification tags. Truthfully Labelled Seed uses an opal green label, Certified Seed features an azure blue tag measuring 15 cm by 7.5 cm, and Breeder Seed bears a golden yellow tag. These distinct labels provide official documentation of seed origin, quality standards, and statutory compliance for buyers across commercial markets.

51. (B) 15 cm × 7.5 cm
The official certification tag attached to containers of Certified Seed measures fifteen centimeters in length by seven point five centimeters in width. Printed on durable azure blue material, this tag contains essential details including crop variety, purity percentages, germination rate, net weight, testing date, and issuing agency details to guarantee statutory compliance and quality standards.

52. (D) Submitted sample
In a certified seed testing laboratory, the working sample used for physical purity testing is obtained by mechanically dividing the submitted sample using precision seed dividers. This process ensures that the working sample represents a statistically unbiased, homogenous fraction of the larger submitted sample, delivering accurate and repeatable seed quality assessment results for official verification.

53. (B) Vegetative reproduction ensures complete genetic uniformity (clonal purity) of the crop
Vegetative propagation using sugarcane setts ensures complete genetic uniformity, known as clonal purity, across generations. Unlike true botanical seeds produced via sexual reproduction that exhibit genetic segregation and variability, clonal propagation preserves desirable agronomic traits, high sucrose content, disease resistance, and uniform growth performance identical to the elite parent cane plant throughout commercial cultivation fields.

54. (C) 9 months
Under standard seed certification regulations, a seed certification tag remains valid for a maximum period of nine months from the date of the initial laboratory testing. If certified seeds remain unsold beyond nine months, the seed lot must undergo re-testing for germination capacity to revalidate certification status before commercial distribution to farmers.

55. (D) Truthfully Labelled Seed
Truthfully Labelled Seed refers to seeds produced and marketed by seed producers or private seed companies with their own self-declared quality standards printed on an opal green tag. While not officially certified by State Seed Certification Agencies, Truthfully Labelled Seeds must strictly meet legal purity and germination standards mandated under the Indian Seeds Act.

56. (A) Farmers regularly purchase certified seeds from reliable external sources
A high Seed Replacement Rate in an agricultural district signifies that local farmers regularly purchase and sow certified or quality seeds from reliable commercial sources rather than relying on uncertified farm-saved seeds. This trend

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reflects high technological adoption, leading to improved genetic potential, superior crop performance, increased disease tolerance, and enhanced overall agricultural productivity across farming regions.

57. (B) Dipping setts in an aqueous biofertilizer solution for 30 minutes
Treating sugarcane setts with liquid biofertilizers like Azotobacter and Phosphate Solubilizing Bacteria involves dipping cut setts in an aqueous biofertilizer solution for thirty minutes before field planting. This immersion technique ensures uniform colonization of vegetative buds and root primordia with beneficial bacterial strains, enhancing nitrogen fixation, phosphorus solubilization, and early seedling vigor after planting.

58. (B) Aluminium phosphide
Aluminium phosphide is the most widely recommended fumigant chemical for protecting stored grain and seed godowns against destructive insect pests. Upon exposure to atmospheric moisture, it releases toxic phosphine gas that penetrates seed stacks to eradicate all life stages of storage insects without compromising seed embryo viability, germination capacity, or seedling vigor when applied correctly.

59. (A) 1% increase in seed moisture or 5°C increase in storage temperature
Harrington's thumb rules for seed storage state that the storage life of orthodox seeds is halved for every one percent increase in seed moisture content or every five degrees Celsius increase in storage temperature. Conversely, reducing moisture or temperature within safe physiological limits doubles seed longevity, emphasizing strict climate and moisture control in godowns.

60. (C) Red Rot
Red Rot, caused by the fungal pathogen Colletotrichum falcatum, is widely known as the cancer of sugarcane due to its devastating economic impact in major sugarcane growing belts. Transmitted primarily through infected seed setts and soil, it causes stalk reddening, pith drying, alcohol-like odor, and complete crop drying, necessitating clean seed setts and fungicide treatment.

61. (D) Breeder Seed
Breeder Seed containers are distinguished by a Golden Yellow tag carrying the signature of the responsible plant breeder. This specialized tag serves as official authentication that the enclosed seed stock was produced directly under scientific supervision, possessing highest genetic and physical purity, forming the base stock for subsequent foundation seed multiplication cycles within seed programs.

62. (A) 3 meters
Self-pollinated crops like wheat and paddy require a standard minimum isolation distance of three meters for certified seed production. Since natural cross-pollination occurs at negligible frequencies in self-pollinated species, a three-meter physical separation effectively prevents mechanical mixture during agricultural operations while preserving complete varietal purity and genetic integrity during seed crop cultivation in fields.

63. (B) It transmits Ratoon Stunting Disease (RSD) mechanically between setts
Using unsterilized cutting knives continuously during sugarcane sett preparation mechanically transmits Ratoon Stunting Disease, caused by the bacterium Leifsonia xyli subsp. xyli. The bacterial pathogen present in sap from infected stalks contaminates the blade, easily inoculating vascular bundles of healthy setts cut subsequently, leading to vascular clogging, stunted ratoon growth, and significant yield losses.

64. (A) Section 3
The Central Seed Committee was formally established under Section 3 of the Indian Seeds Act of 1966. Serving as a statutory advisory body to central and state governments, the committee provides expert guidance on seed policy implementation, variety notification, quality control parameters, seed standards formulation, and administrative regulations governing the seed industry across the nation.

65. (A) Nucleus Seed
Nucleus Seed possesses absolute hundred percent genetic and physical purity, serving as the foundational starting material for all subsequent seed generation stages. Produced under direct supervision of the originating plant breeder, it contains no off-types or contaminants. Its

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propagation yields Breeder Seed, forming the initial link in the structured national seed multiplication pipeline.

66. (C) Spaced Transplanting Technique
In sugarcane agronomy, STP stands for Spaced Transplanting Technique. This specialized planting method involves raising single-budded sugarcane setts in nursery beds or plastic trays and transplanting young, vigorous seedlings into main fields at wider, precise spacings. STP significantly reduces required seed material quantity, enhances tiller survival, and improves light interception and overall cane yields.

67. (A) To break hard seed coat dormancy, allowing water permeability
Mechanical seed scarification is a physical processing technique used to scratch, abrade, or crack hard, impermeable seed coats in species exhibiting physical dormancy. By creating minor abrasions on the seed coat, scarification allows essential water and oxygen to penetrate seed tissues, triggering metabolic activity, breaking dormancy, and promoting rapid, uniform germination upon field sowing.

68. (D) Krishi Raksha Ikaies / Government Seed Stores
In Uttar Pradesh, block-level distribution of subsidized certified seeds, plant protection chemicals, and agricultural inputs is managed through Krishi Raksha Ikaies and Government Seed Stores operated by the State Department of Agriculture. These centers ensure timely access to genuine inputs, subsidized seeds, direct benefit transfers, and technical advice for rural farming communities across districts.

69. (B) Bacterial blights and soil-borne wilts
Pseudomonas fluorescens is a versatile plant growth-promoting rhizobacterium widely applied as a biological seed treatment to combat bacterial blights and soil-borne fungal wilts. It operates through multiple biocontrol mechanisms, including siderophore production, secretion of antifungal antibiotics, competition for root colonization sites, and induction of systemic resistance in developing crop seedlings during early growth stages.

70. (B) 15 to 30 minutes
Soaking sugarcane setts in a recommended fungicidal solution, such as Carbendazim, for fifteen to thirty minutes ensures thorough chemical absorption into nodal tissues and bud sheaths. This adequate contact time effectively neutralizes seed-borne fungal spores, protects setts against soil-borne pathogens causing sett rot, and promotes healthy shoot emergence after planting in fields.

71. (D) Sand, stones, chaff, and seed fragments under half size
During laboratory physical purity analysis, Inert Matter includes non-seed material such as sand particles, soil, stones, chaff, stems, leaves, and damaged seed fragments measuring less than half their original size. Inert matter represents non-viable physical contaminants that dilute seed lot quality, and its percentage by weight is accurately quantified during official seed testing.

72. (C) -18°C
Orthodox seeds intended for long-term conservation in national or international gene banks are dried to five to seven percent moisture content and stored at minus eighteen degrees Celsius. Under these ultra-low temperatures and low moisture conditions, metabolic respiration declines to near zero, preserving seed viability, genetic integrity, and germinability for decades or centuries.

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73. (B) 5% Lysol or Formalin solution
To prevent mechanical transmission of bacterial pathogens causing Ratoon Stunting Disease through sett-cutting knives, harvesting and cutting tools must be sterilized regularly by dipping or wiping with a five percent Lysol or Formalin solution. Chemical sterilization inactivates bacterial cells present in cane sap on cutting edges, safeguarding healthy planting setts from cross-contamination during preparation.

74. (B) Upgrading farm-saved seed quality through local farmer training
The Seed Village Scheme focuses on training farmers in scientific seed production, post-harvest handling, and storage practices within designated farming communities. By upgrading the quality of farm-saved seeds and encouraging seed exchange among local farmers, the scheme enhances self-reliance, increases local availability of quality seeds, and accelerates adoption of improved varieties to raise crop yields.

75. (A) Removing off-types and diseased plants from the seed plot
Roguing is the systematic physical identification and removal of off-types, diseased plants, wild species, and objectionable weed plants from a seed production field. Conducted at critical growth stages, roguing prevents unwanted cross-pollination and physical seed admixture, ensuring that harvested seeds maintain high genetic purity, varietal authenticity, and disease-free certification standards before commercial processing.

76. (C) Sitophilus oryzae (Rice weevil)
Sitophilus oryzae, commonly known as the rice weevil, is a primary internal storage pest causing extensive structural damage to stored wheat seeds. Female weevils bore into kernels to deposit eggs, and developing larvae consume seed endosperm. Maintaining seed moisture levels below ten percent suppresses insect reproduction and larval development, effectively preserving stored grain quality.

77. (D) Two-budded setts placed circularly in deep pits
The Ring Pit planting method for sugarcane involves digging circular pits of specified dimensions and arranging two-budded setts circularly along the pit perimeter. Pits are fortified with organic manure and covered with soil. This geometry provides optimal root space, efficient water utilization, micro-climate protection, and superior tiller survival, resulting in exceptionally high cane yields per unit area.

78. (C) It is monitored directly by the plant breeder, requiring no state certification
Breeder Seed is produced directly under the supervision of the originating plant breeder or agricultural university researcher, who assumes direct responsibility for maintaining absolute genetic purity. Because qualified plant scientists oversee all field evaluation, roguing, and harvesting operations, Breeder Seed is exempt from standard field inspections and certification procedures conducted by State Seed Certification Agencies.

79. (B) Truthfully Labelled Seed
A seed container bearing a fluorescent Opal Green tag designates Truthfully Labelled Seed. This label indicates that the seed lot has been tested and packaged by the producer with self-declared quality guarantees regarding purity and germination performance, fulfilling legal requirements under the Indian Seeds Act without undergoing official State Seed Certification Agency verification.

80. (D) To identify Other Distinguishable Varieties present in the seed lot
An Other Distinguishable Varieties test is a specialized laboratory or field examination conducted during seed quality control to identify and quantify seeds or plants belonging to other distinct varieties of the same crop species. Identifying off-type seeds ensures that commercial seed lots fulfill prescribed minimum genetic purity standards required for official seed certification.

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CHAPTER 06

Principles of Crop Protection and Pest Management

1. Which category of agricultural pests generally causes the maximum percentage of yield loss in crop production globally and in India?
(A) Insect pests
(B) Weeds
(C) Fungal pathogens
(D) Rodents

2. The primary objective of crop protection is to safeguard crops from pests, diseases, and weeds. Which of the following is considered an indirect benefit of effective crop protection?
(A) Complete eradication of all insect species from the field
(B) Prevention of pre-harvest quantitative losses
(C) Immediate increase in soil organic carbon
(D) Preservation of crop quality and market value

3. In the context of pest management, what does the term 'Economic Threshold Level' (ETL) signify?
(A) The pest population density at which control measures should be initiated to prevent economic damage
(B) The lowest pest population density that will cause economic damage
(C) The point at which pest eradication is fully achieved
(D) The stage where crop yield loss reaches 100 percent

4. Given below are two statements: an Assertion (A) and a Reason (R).
Assertion (A): Effective crop protection strategies are essential for achieving national food security.
Reason (R): Severe epidemics of diseases and pests can cause complete crop failure and threaten food supplies.
(A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
(B) Both Assertion (A) and Reason (R) are true but R is not the correct explanation of A.
(C) Assertion (A) is true but Reason (R) is false.
(D) Assertion (A) is false but Reason (R) is true.

5. Which type of nozzle is most commonly recommended for the uniform application of herbicides in agricultural fields?
(A) Flat fan nozzle
(B) Hollow cone nozzle
(C) Solid cone nozzle
(D) Adjustable nozzle

6. Match List I with List II:
List I: (Type of Application equipment)
P. High Volume Sprayer
Q. Low Volume Sprayer
R. Ultra Low Volume (ULV) Sprayer
S. Duster
List II: (Spray volume required per hectare)
1. Less than 5 Litres
2. 5 to 400 Litres
3. Dry powder application
4. More than 400 Litres
(A) P-4, Q-2, R-1, S-3
(B) P-2, Q-4, R-3, S-1
(C) P-4, Q-1, R-2, S-3
(D) P-1, Q-2, R-3, S-4

7. The standard operating pressure for a manually operated knapsack sprayer used in field crops is generally maintained between:
(A) 0.5 to 1.0 kg/cm2
(B) 2.5 to 3.0 kg/cm2
(C) 5.0 to 7.0 kg/cm2
(D) 10.0 to 15.0 kg/cm2

8. Under which of the following field conditions is dusting preferred over liquid spraying for pest control?
(A) When humidity is extremely low and winds are high
(B) When systemic action of the chemical is highly required
(C) In areas with acute water scarcity and uneven terrain
(D) During heavy rainfall periods

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9. Confidor is a popular trade name for which of the following widely used systemic insecticides?
(A) Chlorpyrifos
(B) Malathion
(C) Quinalphos
(D) Imidacloprid

10. Which of the following is NOT classified as a systemic insecticide?
(A) Chlorpyrifos
(B) Dimethoate
(C) Methyl demeton
(D) Thiamethoxam

11. Consider the following statements regarding the classification of insecticides based on their mode of entry:
I. Stomach poisons are effective against chewing insects when ingested along with plant parts.
II. Contact poisons kill the insect only when the chemical is absorbed through the plant's vascular system.
III. Systemic insecticides are translocated within the plant and are highly effective against sap-sucking insects.
Which of the above statement(s) is/are correct?
(A) I and II only
(B) II and III only
(C) I and III only
(D) I, II and III

12. A fungicide that is absorbed by the plant foliage and translocated to other plant parts to protect new growth is known as a:
(A) Contact fungicide
(B) Systemic fungicide
(C) Protectant fungicide
(D) Eradicant fungicide

13. Match List I with List II:
List I: (Toxicity colour band on pesticide label)
P. Red
Q. Yellow
R. Blue
S. Green
List II: (Signal word)
1. Moderately Toxic (Danger)
2. Slightly Toxic (Caution)
3. Extremely Toxic (Poison)
4. Highly Toxic (Poison)
(A) P-3, Q-4, R-1, S-2
(B) P-4, Q-3, R-2, S-1
(C) P-3, Q-1, R-4, S-2
(D) P-1, Q-2, R-3, S-4

14. Which colour triangle on a pesticide container indicates the highest level of toxicity, corresponding to an oral LD50 value of 1 to 50 mg/kg?
(A) Blue
(B) Yellow
(C) Red
(D) Green

15. Based on herbicide selectivity and timing, Pendimethalin is most widely classified and used as a:
(A) Pre-plant incorporated herbicide
(B) Post-emergence herbicide
(C) Non-selective contact herbicide
(D) Pre-emergence herbicide

16. The Bordeaux mixture, a highly effective and traditional fungicide, is prepared by mixing:
(A) Copper oxychloride, gypsum, and water
(B) Sulphur, slaked lime, and water
(C) Copper sulphate, quick lime, and water
(D) Zinc sulphate, quick lime, and water

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17. The fundamental concept of Integrated Pest Management (IPM) is best described as:
(A) Eradicating all target pest populations completely using intensive calendar-based chemical doses
(B) Managing pest populations below the economic injury level through integrated control tactics
(C) Relying exclusively on biological control agents without utilizing any synthetic chemical inputs
(D) Applying broad-spectrum chemical pesticides on a rigid calendar basis regardless of pest density

18. Which of the following is an example of a physical control method in crop protection?
(A) Deploying synthetic pheromone traps in the field to disrupt insect mating behavior
(B) Releasing mass-reared Trichogramma parasitic wasps into the field for pest control
(C) Practicing systematic crop rotation with non-host plant species across seasons
(D) Subjecting seed setts to hot water baths to eliminate seed-borne pathogens

19. Given below are two statements: an Assertion (A) and a Reason (R).
Assertion (A): Integrated Pest Management

(IPM) does not aim for the complete eradication of pest populations from an agro-ecosystem.
Reason (R): Maintaining a low-level pest population ensures the survival and continuous presence of natural enemies in the field.
(A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
(B) Both Assertion (A) and Reason (R) are true but R is not the correct explanation of A.
(C) Assertion (A) is true but Reason (R) is false.
(D) Assertion (A) is false but Reason (R) is true.

20. Trichogramma chilonis, widely utilized in sugarcane pest management, acts as a beneficial:
(A) Larval parasitoid
(B) Pupal predator
(C) Egg parasitoid
(D) Pathogenic fungus

21. Consider the following statements regarding the major components of biological control in IPM:
I. Parasitoids lay their eggs in or on the body of the host insect, eventually killing it.
II. Predators are free-living organisms that consume multiple prey insects during their lifetime.
III. Pathogens used in biocontrol include specific viruses, bacteria, and fungi that cause diseases in insect pests.
IV. Botanical extracts like Neem oil are considered living biological control agents.
Which of the above statement(s) is/are correct?
(A) I, II and III only
(B) I, III and IV only
(C) II, III and IV only
(D) I, II, III and IV

22. Deep summer ploughing is a popular cultural control practice primarily because it:
(A) Increases the accumulation of viable weed seeds within the upper topsoil profile
(B) Traps adult flying insect pests mechanically through disturbed soil surface layers
(C) Promotes the rapid multiplication and survival of beneficial soil-borne nematodes
(D) Exposes resting soil pests and pathogens to intense sunlight and natural predators

23. Pheromone traps used in pest monitoring and mass trapping most commonly utilize:
(A) Alarm pheromones to scare away pests
(B) Synthetic sex pheromones to attract male moths
(C) Aggregation pheromones to attract beneficial insects
(D) Trail pheromones to disrupt ant colonies

24. Which of the following beneficial insects is a well-known active predator of aphids and other soft-bodied sap-sucking pests?
(A) Whitefly
(B) Stem borer
(C) Ladybird beetle
(D) Leafhopper

25. Select the correct sequence of pest management interventions in the IPM hierarchy, proceeding from base preventive measures to ultimate reactive measures:
(A) Chemical control → Biological control → Mechanical control → Cultural control
(B) Cultural control → Physical/Mechanical control → Biological control → Chemical control
(C) Biological control → Cultural control → Chemical control → Physical control
(D) Chemical control → Cultural control → Biological control → Mechanical control

26. The bio-pesticide Nuclear Polyhedrosis Virus (NPV) is most effective and specifically used against the larval stages of which insect order?
(A) Order Lepidoptera (caterpillars)
(B) Order Coleoptera (beetles and weevils)
(C) Order Diptera (flies and mosquitoes)
(D) Order Hemiptera (true bugs and aphids)

27. The term 'Waiting Period' or 'Pre-Harvest Interval (PHI)' in chemical crop protection refers to:
(A) The exact duration required for treated seeds to complete germination after sowing
(B) The mandatory time interval required between pesticide application and crop harvest
(C) The safe operational time gap needed between crop sowing and the initial pesticide spray
(D) The total time required for a contact insecticide to eliminate target pests in the field

28. Which of the following practices is considered highly unsafe and must be avoided during the preparation and application of chemical pesticides?
(A) Wearing protective rubber gloves, face shields, and closed boots during mixing

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(B) Clearing a clogged sprayer nozzle directly by mouth during field operations
(C) Spraying chemical formulations downwind in the same direction as the wind flow
(D) Thoroughly reading the pesticide toxicity label instructions prior to chemical mixing

29. The excessive and continuous use of a single class of chemical insecticide often leads to:
(A) Development of resistance in target pest populations
(B) Permanent local eradication of all targeted pest species in the crop field
(C) A rapid increase in the active population of beneficial natural enemies
(D) Enhanced biological nitrogen fixation by soil microorganisms in the field

30. Given below are two statements: an Assertion (A) and a Reason (R).
Assertion (A): Indiscriminate use of broad-spectrum chemical insecticides frequently results in the outbreak of secondary pests.
Reason (R): Broad-spectrum insecticides indiscriminately kill both target pests and their natural enemies, allowing minor pests to multiply unchecked.
(A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
(B) Both Assertion (A) and Reason (R) are true but R is not the correct explanation of A.
(C) Assertion (A) is true but Reason (R) is false.
(D) Assertion (A) is false but Reason (R) is true.

31. The primary purpose of calibrating a plant protection sprayer before actual field application is to:
(A) Increase the inherent chemical toxicity class of the prepared pesticide formulation
(B) Convert a contact insecticide formulation into a fully systemic active compound
(C) Determine the precise active ingredient percentage present in the chemical spray
(D) Ensure accurate delivery of the recommended spray volume per unit area

32. In the context of food safety and pesticide regulation, the acronym 'MRL' stands for:
(A) Minimum Required Limit
(B) Marginal Risk Level
(C) Maximum Residue Limit
(D) Maximum Resistance Level

33. The phenomenon where the concentration of a persistent pesticide increases as it moves up successive levels of the food chain is termed:
(A) Biodegradation
(B) Biomagnification
(C) Bioaccumulation
(D) Bioremediation

34. Consider the following statements regarding factors that influence the level of pesticide residue remaining in harvested crops:
I. The chemical nature and degradation half-life of the active ingredient.
II. The application dose and frequency of pesticide sprays.
III. The environmental conditions like temperature, rainfall, and sunlight post-application.
Which of the above statement(s) is/are correct?
(A) I and II only
(B) II and III only
(C) I and III only
(D) I, II and III

35. Zygogramma bicolorata, a well-known beneficial insect in biological weed control, was successfully introduced in India to manage:
(A) Parthenium or Carrot grass (Parthenium hysterophorus)
(B) Free-floating aquatic water hyacinth (Eichhornia crassipes)
(C) Creeping perennial Bermuda grass (Cynodon dactylon)
(D) Perennial purple nut sedge weed (Cyperus rotundus)

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36. Which of the following is an active ingredient commonly extracted from the Neem tree (Azadirachta indica) and used as a potent botanical biopesticide?
(A) Pyrethrin extract
(B) Rotenone compound
(C) Azadirachtin
(D) Nicotine compound

37. Consider the following statements regarding the Central Insecticides Act, 1968:
I. It aims to regulate the import, manufacture, sale, transport, distribution, and use of insecticides.
II. Its primary objective is to prevent risk to human beings or animals.
III. Under this Act, all pesticides must be registered with the Central Insecticides

Board and Registration Committee (CIBRC) before sale.
IV. The Act mandates that the sale of pesticides is entirely unregulated and requires no licensing for retail.

Which of the above statement(s) is/are correct?
(A) I, II and III only
(B) II, III and IV only
(C) I, III and IV only
(D) I, II, III and IV

38. Bacillus thuringiensis (Bt) is a soil-dwelling bacterium extensively formulated and applied as a commercial bio-insecticide. Its toxic action is primarily due to:
(A) Systemic production of potent fungicidal compounds that suppress internal cellular respiration
(B) Secretion of specialized chemical enzymes that dissolve insect exoskeletons externally on contact
(C) Physical obstruction and mechanical blocking of the insect's respiratory spiracles across the body
(D) Production of crystalline endotoxins causing midgut destruction upon ingestion

39. Match List I with List II:
List I: (Bio-pesticide / Bio-agent)
P. Trichoderma viride
Q. Beauveria bassiana
R. Bacillus thuringiensis
S. Pseudomonas fluorescens
List II: (Primary Target/Use)
1. Lepidopteran caterpillars
2. Soil-borne fungal pathogens (wilt/root rot)
3. Plant-growth-promoting rhizobacteria (disease suppression)
4. Soft-bodied and sap-sucking insects (entomopathogenic fungus)
(A) P-2, Q-4, R-1, S-3
(B) P-1, Q-3, R-2, S-4
(C) P-4, Q-2, R-1, S-3
(D) P-2, Q-1, R-4, S-3

40. In a zero-tillage agricultural system, which non-selective contact herbicide is most frequently used to burn down existing weed vegetation before sowing?
(A) 2,4-D
(B) Isoproturon
(C) Paraquat
(D) Pendimethalin

41. Epipyrops melanoleuca is an effective biological control agent extensively recommended and conserved in Uttar Pradesh to manage which serious pest of sugarcane?
(A) Sugarcane top borer
(B) Sugarcane early shoot borer
(C) Sugarcane root borer
(D) Sugarcane pyrilla

42. A sugarcane field exhibits crop damage characterized by "dead hearts" that emit a highly offensive odour and can be easily pulled out. This is the characteristic damage symptom of:
(A) Early shoot borer
(B) Sugarcane top borer
(C) Sugarcane internode borer
(D) Sugarcane mealy bug

43. A typical symptom of Sugarcane Top Borer attack in the growing crop is:
(A) Complete drying and premature senescence of lower foliage leaves across the stalk
(B) Dead heart formation with parallel rows of shot holes on emerging leaves
(C) Distinct pinkish discoloration of the pith observed when stalks are split open
(D) Severe wilting and collapse of the entire plant clump without visible leaf damage

44. The devastating disease known as the "cancer of sugarcane," which causes sour smelling internal reddening of the cane tissues interrupted by white transverse bands, is caused by:
(A) Ustilago scitaminea
(B) Colletotrichum falcatum
(C) Leifsonia xyli
(D) Phytoplasma

45. Which of the following cultural practices is strictly prohibited in a sugarcane field that is severely infected with Red Rot disease?
(A) Taking a ratoon crop
(B) Deep ploughing after harvest
(C) Crop rotation with paddy
(D) Applying farm yard manure

46. Grassy Shoot Disease (GSD) in sugarcane, characterized by the production of numerous thin, chlorotic tillers resembling a clump of grass, is caused by:
(A) Plant parasitic nematodes
(B) Soil-borne fungi
(C) Phytoplasma

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(D) Plant pathogenic bacteria

47. Consider the following steps for sugarcane planting and disease management:
I. Treating the setts in a fungicide-insecticide solution
II. Selection of healthy, disease-free seed cane from a primary nursery
III. Planting the setts in trenches or furrows
IV. Cutting the seed cane into three-budded setts
Which of the following represents the correct chronological order?
(A) II, IV, I, III
(B) II, I, IV, III
(C) IV, II, I, III
(D) I, II, IV, III

48. To protect planted sugarcane setts from termite attack in the soil, which insecticide formulation is commonly applied over the setts in the furrows before closing them?
(A) Carbendazim 50% WP formulation
(B) Glyphosate 41% SL formulation
(C) Chlorpyrifos 20% EC
(D) Mancozeb 75% WP formulation

49. Ratoon Stunting Disease (RSD) in sugarcane is a highly contagious bacterial disease primarily transmitted from field to field through:
(A) Airborne fungal spores carried by wind currents
(B) Contaminated field harvesting tools
(C) Surface runoff of field irrigation water
(D) Leaf-feeding caterpillar insect vectors

50. The emergence of a long, black, whip-like structure from the central core of the sugarcane apex is the diagnostic symptom of which disease?
(A) Red Rot
(B) Wilt
(C) Pokkah Boeng
(D) Smut

51. Given below are two statements: an Assertion (A) and a Reason (R).
Assertion (A): Trash mulching in ratoon sugarcane is an effective cultural weed management practice.
Reason (R): The thick layer of dry trash suppresses weed seed germination by physically blocking sunlight and reducing soil temperature fluctuations.
(A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
(B) Both Assertion (A) and Reason (R) are true but R is not the correct explanation of A.
(C) Assertion (A) is true but Reason (R) is false.
(D) Assertion (A) is false but Reason (R) is true.

52. Consider the following statements regarding Integrated Weed Management (IWM) in sugarcane:
I. The critical period of crop-weed competition in autumn planted sugarcane is generally between 60 to 120 days.
II. Blind hoeing is practiced before the emergence of sugarcane shoots to control early germinating weeds.
III. Intercropping sugarcane with fast-growing pulse crops suppresses weed growth and improves soil fertility.
Which of the above statement(s) is/are correct?
(A) I and II only
(B) II and III only
(C) I and III only
(D) I, II and III

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53. Which of the following herbicides is widely recommended as a pre-emergence spray in sugarcane fields to effectively control broadleaf weeds and annual grasses?
(A) Atrazine
(B) Glyphosate
(C) 2,4-D
(D) Paraquat

54. Match List I with List II:
List I: (Sugarcane Pest)
P. Top borer
Q. Early shoot borer
R. Root borer
S. Pyrilla
List II: (Specific Damage Symptom)
1. Yellowing of leaves, sooty mould development due to honeydew secretion
2. Dead heart emitting a foul smell, easily pulled out
3. Dead heart cannot be easily pulled out, bunchy top appearance at later stages
4. Yellowing of leaves, drying of the entire clump, galleries in the root zone
(A) P-3, Q-2, R-4, S-1
(B) P-2, Q-3, R-1, S-4
(C) P-3, Q-1, R-4, S-2
(D) P-4, Q-2, R-3, S-1

55. To eliminate seed-borne pathogens like Smut and Grassy Shoot Disease from sugarcane seed material, setts are subjected to Hot Water Treatment. What is the standard recommended temperature and time for this treatment?
(A) 40°C for 30 minutes duration
(B) 50°C for 2 to 2.5 hours
(C) 60°C for 60 minutes duration
(D) 70°C for 15 minutes duration

56. Which of the following is considered the most critical limitation or disadvantage of using biological control methods (bio-pesticides) in field crop protection?
(A) Synthetic formulations leave persistent and highly toxic chemical residues on harvested food crops
(B) Application leads directly to rapid secondary pest resurgence and pest population flare-ups
(C) High target specificity and slower speed of action relative to chemical pesticides
(D) Chemical actions destroy the physical soil structure and beneficial microbial biological activity

57. The Economic Injury Level (EIL) in pest management is formally defined as:
(A) The specific pest population threshold where crop yield reduction exceeds five percent
(B) The steady-state population density where natural enemies maintain complete biological control
(C) The maximum pest population density a crop canopy can tolerate without measurable damage
(D) Lowest pest population causing economic damage equal to control costs

58. To achieve maximum efficiency and adherence to the crop canopy, the application of chemical dusts using a duster should ideally be done:
(A) In the early morning when dew is present on the leaves
(B) During mid-day hours when ambient field temperatures reach their daily peak
(C) During strong wind conditions to promote maximum chemical drift and spread
(D) Immediately following heavy rainfall events when canopy wetness is high

59. The pressure vessel or air chamber in a manual knapsack sprayer serves the primary function of:
(A) Heating the chemical spray mixture within the tank to enhance pesticide solubility
(B) Maintaining continuous, uniform spray discharge at the nozzle
(C) Filtering physical particulate impurities and debris directly from the spray liquid
(D) Enhancing the inherent chemical toxicity and action of the active ingredient

60. Which class of fungicides, known for its exceptional systemic action, is specifically highly effective against Oomycetes pathogens causing downy mildews?
(A) Dithiocarbamates (e.g., Mancozeb)
(B) Phenylamides (e.g., Metalaxyl)
(C) Benzimidazoles (e.g., Carbendazim)
(D) Copper compounds (e.g., Copper oxychloride)

61. Based on their biochemical mode of action, organophosphate insecticides (like Malathion and Chlorpyrifos) primarily kill insects by:
(A) Inhibiting acetylcholinesterase in the nervous system
(B) Inhibiting chitin synthesis and destroying the insect exoskeleton during moulting
(C) Disrupting mitochondrial electron transport and cellular respiration pathways
(D) Rapidly dissolving the epithelial cells lining the insect midgut tissue

62. Select the correct order of pesticide toxicity classification based on the label colour codes, progressing from least toxic to most toxic:
(A) Green → Blue → Yellow → Red
(B) Green → Yellow → Blue → Red
(C) Blue → Green → Yellow → Red
(D) Yellow → Green → Blue → Red

63. Within an Integrated Pest Management (IPM) system, which method is considered the foundational and most environmentally safe approach for long-term pest prevention?
(A) Regular preventive application of broad-spectrum synthetic pyrethroids
(B) Large-scale aerial spraying of non-selective systemic herbicides
(C) Chemical soil fumigation utilizing persistent methyl bromide compounds
(D) Adoption of cultural practices and resistant varieties

64. To manage tissue-boring pests in sugarcane without using harsh chemicals, which specific

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biological agent is mass-multiplied in laboratories and released as "tricho-cards" in the fields?
(A) Cotesia flavipes
(B) Chrysoperla carnea
(C) Trichogramma chilonis
(D) Epiricania melanoleuca

65. The cultural practice of adjusting the time of sowing (early or delayed sowing) is primarily aimed at:
(A) Increasing the overall uptake efficiency and synthetic dosage requirement of nitrogen fertilizers
(B) Disrupting synchronization between crop susceptible stages and peak pest emergence
(C) Completely eradicating dormant weed seeds situated deep within the lower soil profile
(D) Substantially enhancing the long-term moisture retention capacity of topsoil layers

66. Yellow sticky traps installed in agricultural fields are highly effective for monitoring and managing the populations of:
(A) Soil-inhabiting whitegrubs and plant parasitic nematodes
(B) Flying adult noctuid moths including Helicoverpa species
(C) Field rodents and destructive vertebrate pest species
(D) Sucking insects like aphids, whiteflies, and jassids

67. The practice of maintaining floral resources, such as marigold or cowpea, on field bunds and borders is a component of IPM designed to:
(A) Conserve and build natural enemy populations (predators and parasitoids)
(B) Repel all insect pest species completely from entering the main crop field
(C) Significantly increase the biological activity and efficiency of herbicides
(D) Provide a dense physical barrier stopping all wind-borne plant diseases

68. The phenomenon known as a "secondary pest outbreak" occurs primarily because:
(A) Introduced biological control agents mutate and transform into primary crop pests
(B) Crop varieties rapidly lose intrinsic resistance and become vulnerable to major pests
(C) Broad-spectrum sprays destroy natural enemies that controlled minor pests
(D) Mass deployment of pheromone traps actively attracts pests from adjacent regions

69. In the event of accidental pesticide poisoning through severe skin exposure (dermal contact) during spraying operations, the immediate first aid response should be to:
(A) Remove contaminated clothing and wash skin thoroughly with soap and water
(B) Immediately induce artificial vomiting using warm saline water solutions
(C) Apply a strong chemical neutralizing base solution directly to affected areas
(D) Keep the patient calm and wait for systemic toxicity symptoms before acting

70. Proper calibration of plant protection equipment is essential to determine the:
(A) Chemical purity and physical quality of water utilized for spray mixing
(B) Regulatory toxicological hazard classification of the pesticide product
(C) Expected market price and economic value of the harvested crop produce
(D) Liquid discharge volume per unit time and field area

71. Consider the following statements regarding the safe storage and disposal of pesticides:
I. Pesticides must always be stored in their original, clearly labelled containers.
II. Empty pesticide containers should be washed, punctured, and buried safely away from water sources.
III. Pesticides should be stored in a cool, dry place secured under lock and key, out of reach of children.
IV. Leftover pesticide spray mixtures can be safely poured into the nearest irrigation canal or pond.
Which of the above statement(s) is/are correct?
(A) I, II and III only
(B) II, III and IV only
(C) I, III and IV only
(D) I, II, III and IV

72. The Acceptable Daily Intake (ADI) of a pesticide residue in food crops is fundamentally calculated based on:
(A) Maximum yield potential and structural biomass production capacity of the crop
(B) Total chemical volume applied annually across a specific agro-climatic zone
(C) Toxicological animal feeding studies establishing the NOAEL threshold
(D) Consumer market demand and visual aesthetic standards for unblemished produce

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73. Halosulfuron-methyl is a specialized selective herbicide strongly recommended in sugarcane cultivation primarily for the effective post-emergence control of:
(A) Parasitic weeds like Striga species
(B) Annual broadleaf weeds like Parthenium hysterophorus
(C) Woody perennial shrub species
(D) Nut sedge (Cyperus rotundus)

74. Which of the following fungal bio-agents is extensively used as a seed treatment and soil application to combat soil-borne plant pathogens like Fusarium and Rhizoctonia?
(A) Trichoderma viride
(B) Metarhizium anisopliae
(C) Verticillium lecanii
(D) Penicillium notatum

75. The nodal agency at the national level responsible for advising the Central and State Governments on technical matters related to pesticide registration, safety, and regulation is the:
(A) Indian Council of Agricultural Research (ICAR)
(B) Central Insecticides Board and Registration Committee (CIBRC)
(C) National Bureau of Plant Genetic Resources (NBPGR)
(D) Commission for Agricultural Costs and Prices (CACP)

76. Pokkah Boeng, an important foliar disease of sugarcane characterized by distorted, wrinkled, and shortened leaves near the top, is caused by the fungus:
(A) Puccinia melanocephala
(B) Fusarium moniliforme (Fusarium sacchari)
(C) Cercospora longipes
(D) Ustilago scitaminea

77. Which cultural operation is specifically recommended to mechanically destroy the hiding places of sugarcane early shoot borer and suppress weed growth during the early stages of the crop?
(A) Blind hoeing
(B) Crop propping
(C) Cane tying
(D) Leaf detrashing

78. In sugarcane crop management, the physical practice of 'earthing up' serves multiple purposes. Which of the following is its most significant benefit in crop protection?
(A) It permanently eliminates and prevents the incidence of Red Rot fungal disease
(B) It completely eliminates the agronomic need for applying nitrogenous fertilizers
(C) Prevents plant lodging and suppresses late-emerging weeds
(D) It acts as an absolute mechanical barrier against flying sucking pests like Pyrilla

79. Consider the following statements regarding Grassy Shoot Disease in sugarcane:
I. It is caused by a phytoplasma.
II. The disease is primarily transmitted in the field by leafhoppers.
III. Infected setts serve as a major primary source of inoculum.
Which of the above statement(s) is/are correct?
(A) I and II only
(B) II and III only
(C) I and III only
(D) I, II and III

80. A farmer applied a highly toxic systemic insecticide to a crop just two days before harvest, completely violating the recommended 'Waiting Period'. What is the most immediate adverse consequence of this action concerning food safety?
(A) The harvested crop produce will undergo rapid biological rotting immediately during post-harvest storage
(B) The overall nutritional content and protein value of the harvested crop will double automatically
(C) Pesticide residues exceeding MRL pose acute health risks to consumers
(D) Targeted insect pest species will instantly develop complete genetic resistance across the field

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ANSWERS

1. (B) Weeds
Weeds cause the highest percentage of yield loss in crop production both globally and in India, surpassing losses caused by insect pests, fungal pathogens, and rodents. They compete aggressively with cultivated crops for essential growth factors such as light, moisture, nutrients, and space, thereby severely suppressing potential crop development and reducing overall harvest outputs.

2. (D) Preservation of crop quality and market value
Effective crop protection directly prevents quantitative yield reductions by shielding plants from active pest damage. Additionally, it preserves the visual, nutritional, and physical quality of harvested produce, which serves as a major indirect benefit. Protecting crop appearance and grain integrity ensures higher commodity standards, reduced post-harvest spoilage, and enhanced commercial market value during trade.

3. (A) The pest population density at which control measures should be initiated to prevent economic damage
The economic threshold level represents the specific pest population density at which management intervention must be implemented. Initiating control measures at this critical threshold prevents the growing pest population from expanding further and reaching the economic injury level, thereby safeguarding the crop from experiencing financial losses that exceed the actual cost of applying pest control operations.

4. (A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
Crop protection practices are vital for national food security because unchecked pest populations and disease outbreaks can destroy vast agricultural areas. When severe epidemics occur, total crop failure drastically reduces food production across regions. Preventing these widespread agricultural losses through effective protection measures ensures a stable, reliable food supply required to sustain populations nationwide.

5. (A) Flat fan nozzle
Flat fan nozzles produce a narrow, fan-shaped spray pattern that delivers uniform liquid distribution across a flat band or continuous boom setup. This even coverage makes them the standard recommendation for herbicide applications, where consistent chemical distribution is essential to prevent weed escapes, avoid crop injury, and ensure complete surface coverage across field foliage.

6. (A) P-4, Q-2, R-1, S-3
Application equipment is categorized by volume requirements per hectare. High volume sprayers require over four hundred litres of water, whereas low volume sprayers operate between five and four hundred litres. Ultra low volume sprayers utilize concentrated formulations under five litres per hectare. Dusters apply dry chemical powders without water, providing effective coverage for dry field conditions.

7. (B) 2.5 to 3.0 kg/cm2
Manually operated knapsack sprayers maintain a standard operational pressure between 2.5 and 3.0 kilograms per square centimetre during field spraying. This specific pressure range ensures optimal droplet atomization and uniform spray distribution without producing excessively fine spray drift. Maintaining proper pressure minimizes chemical waste, reduces drift hazard, and provides thorough coverage over crop foliage.

8. (C) In areas with acute water scarcity and uneven terrain
Dry pesticide dusting is preferred in regions facing severe water shortages or rugged, uneven landscapes where transporting large volumes of water for liquid spraying is impractical. Dusters are lightweight and portable, allowing operators to treat crops effectively without needing water infrastructure, making them suitable for difficult field terrains under arid environmental conditions.

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9. (D) Imidacloprid
Confidor is a widely recognized commercial trade name for imidacloprid, a systemic neonicotinoid insecticide. It acts on the insect central nervous system by binding to nicotinic acetylcholine receptors. Plant foliage and roots absorb the chemical, translocating it throughout internal tissues to effectively eliminate sap-sucking insect pests like aphids, whiteflies, jassids, and thrips.

10. (A) Chlorpyrifos
Chlorpyrifos is an organophosphate compound that functions primarily through contact, stomach, and respiratory vapor action rather than systemic uptake. Unlike systemic insecticides such as dimethoate, methyl demeton, and thiamethoxam, chlorpyrifos is not translocated within the plant vascular system. It controls pests by direct surface contact or ingestion during feeding on treated plant surfaces.

11. (C) I and III only
Stomach poisons kill chewing pests when ingested alongside treated foliage, while systemic insecticides absorb into plant vascular tissues to eliminate sap-sucking insects. Contact poisons do not require absorption through vascular systems; instead, they kill insects directly upon physical contact with the chemical on plant surfaces, making the second statement inaccurate regarding contact poison activity.

12. (B) Systemic fungicide
Systemic fungicides are absorbed by plant leaves or roots and translocated through the vascular system to untreated tissues and new growth. This internal movement protects newly expanding foliage and suppresses established internal fungal infections. In contrast, contact and protectant fungicides remain solely on the exterior plant surface and cannot protect unexposed emerging plant parts.

13. (A) P-3, Q-4, R-1, S-2
Pesticide containers feature standardized toxicity bands to communicate health hazards clearly. The red color band indicates extremely toxic chemicals marked as poison, while yellow represents highly toxic materials. Blue signifies moderately toxic substances with danger signals, and green designates slightly toxic pesticides bearing caution warnings, establishing a clear safety hierarchy for chemical handlers.

14. (C) Red
A red triangular color band on pesticide containers designates the highest toxicity category, representing extremely toxic chemical compounds. These products possess oral lethal dose fifty values ranging between one and fifty milligrams per kilogram of body weight. Handling red-labelled pesticides requires stringent safety precautions due to their severe potential risks to human health and non-target organisms.

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15. (D) Pre-emergence herbicide
Pendimethalin is classified as a selective pre-emergence herbicide used extensively in various agricultural crops. Applied to the soil surface shortly after crop planting but prior to weed seedling emergence, it inhibits cell division and elongation during root and shoot development, effectively controlling germinating annual grasses and broadleaf weeds before they breach the soil surface.

16. (C) Copper sulphate, quick lime, and water
Bordeaux mixture is a classic, effective protectant fungicide prepared by reacting copper sulphate with hydrated or quick lime in water. Typically formulated in a ten to ten to one hundred ratio, this chemical reaction produces basic copper sulphate complexes that adhere strongly to plant foliage, controlling a wide range of fungal and bacterial plant diseases.

17. (B) Managing pest populations below the economic injury level through integrated control tactics
Integrated pest management combines compatible ecological, cultural, biological, and chemical control methods to maintain pest populations below the economic injury level. Rather than pursuing complete species eradication or relying on rigid chemical schedules, it focuses on long-term ecological balance, minimizing economic crop damage while preserving natural predator populations and reducing environmental contamination risks.

18. (D) Subjecting seed setts to hot water baths to eliminate seed-borne pathogens
Hot water treatment of planting material represents a classic physical control method in crop protection. Submerging seed setts or planting stock in heated water at precise temperatures thermalizes and inactivates internal seed-borne fungal, bacterial, and phytoplasma pathogens

without relying on synthetic chemical fungicides, ensuring clean planting material while avoiding chemical residues in soil.

19. (A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
Integrated pest management avoids complete pest eradication because maintaining a tolerable, low-density pest population provides an essential food source for beneficial organisms. Preserving this minimal host population ensures natural enemies, parasitoids, and predators survive and remain active within agro-ecosystems, maintaining continuous biological suppression of potential pest outbreaks over extended crop growth periods.

20. (C) Egg parasitoid
Trichogramma chilonis is a minute hymenopteran wasp widely used as a biological control agent against lepidopteran pests in sugarcane and other crops. Adult female wasps lay their eggs directly inside host insect eggs. Parasitoid larvae consume the host egg contents internally, preventing pest caterpillar emergence and suppressing target pest populations before crop feeding damage occurs.

21. (A) I, II and III only
Parasitoids complete development inside host bodies, predators consume multiple prey individuals, and entomopathogenic microbes cause natural pest diseases. Botanical extracts such as neem oil are bio-chemical pesticides derived from plants rather than living biocontrol organisms, making the fourth statement incorrect while the first three accurately describe biological control agents within integrated pest management systems.

22. (D) Exposing resting soil pests and pathogens to intense sunlight and natural predators
Deep summer ploughing involves tilling fields during hot summer months to invert soil layers. This cultural practice brings dormant soil-inhabiting insect pupae, larvae, weed seeds, and soil-borne fungal pathogens to the surface. Exposure to intense solar radiation, high temperatures, and predatory birds significantly reduces pest survival, lowering primary inoculum levels for subsequent crops.

23. (B) Synthetic sex pheromones to attract male moths
Pheromone traps incorporate synthetic sex pheromones that mimic natural chemical attractants released by female insects. Male adult moths are drawn to the trap source and captured, allowing farmers to monitor pest arrival, assess population densities, determine economic threshold levels, or suppress reproduction through mass trapping and mating disruption techniques within integrated pest management strategies.

24. (C) Ladybird beetle
Ladybird beetles are beneficial predatory insects belonging to the family Coccinellidae. Both larval and adult stages feed voraciously on soft-bodied sap-sucking pests, including aphids, mealybugs, scale insects, and mites. Preserving ladybird beetle populations in agricultural fields provides essential biological suppression, reducing reliance on synthetic chemical insecticides for managing sucking pest populations.

25. (B) Cultural control → Physical/Mechanical control → Biological control → Chemical control
The integrated pest management hierarchy prioritizes preventive foundation practices before deploying intervention measures. Cultural practices form the baseline, followed by physical and mechanical controls to manage pests directly. Biological agents are introduced next to enhance natural control, while chemical pesticides serve as a last resort applied only when pest populations surpass economic thresholds.

26. (A) Order Lepidoptera (caterpillars)
Nuclear Polyhedrosis Virus is a highly host-specific entomopathogenic virus used as a biological pesticide. It specifically infects caterpillar larvae belonging to the order Lepidoptera, such as Helicoverpa armigera and Spodoptera litura. Upon ingestion, viral polyhedra dissolve in the alkaline insect midgut, causing fatal systemic infections while remaining completely harmless to non-target organisms.

27. (B) The mandatory time interval required between pesticide application and crop harvest
The waiting period, or pre-harvest interval, is the mandatory safety duration required between the final pesticide application and crop harvesting. Adhering to this interval allows chemical residues on plants to degrade down

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to safe, legal maximum residue limits, ensuring harvested produce poses no toxicological health risks to consumers upon reaching market outlets.

28. (B) Clearing a clogged sprayer nozzle directly by mouth during field operations
Clearing clogged sprayer nozzles using the mouth exposes operators to direct oral ingestion of toxic chemical concentrate, posing extreme health risks and potential fatal poisoning. Safe handling requires using soft brushes or clean water to clear blockages while wearing full protective equipment, avoiding direct oral or physical contact with pesticide residues during all field operations.

29. (A) Development of resistance in target pest populations
Continuous reliance on a single class of chemical insecticide exerts strong selection pressure on pest populations. Susceptible individuals die, while naturally resistant variants survive and reproduce, eventually dominating field populations. Over time, repeated applications render the chemical ineffective, requiring increased dosages or alternative insecticide classes to achieve satisfactory control across agricultural landscapes.

30. (A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
Broad-spectrum chemical insecticides destroy beneficial predators and parasitoids alongside target pests. Eliminating these natural regulators removes natural biological control mechanisms, allowing minor or non-target pest species to rapidly multiply and reach damaging levels. This phenomenon, known as secondary pest resurgence, directly results from the non-selective toxicity of broad-spectrum chemical sprays.

31. (D) Ensure accurate delivery of the recommended spray volume per unit area
Sprayer calibration involves measuring and adjusting liquid discharge rates, operating pressure, and walking speed prior to field application. Proper calibration ensures the exact recommended volume of spray solution and active chemical ingredient is distributed uniformly per unit area, preventing crop injury from over-application or reduced pest control efficacy caused by under-application.

32. (C) Maximum Residue Limit
Maximum Residue Limit represents the highest legally permitted concentration of a pesticide residue on food or feed products, expressed in milligrams per kilogram. Regulatory authorities establish these limits based on rigorous toxicological trials and good agricultural practices to protect consumer health and enforce trade standards regarding pesticide residues in harvested agricultural commodities.

33. (B) Biomagnification
Biomagnification describes the progressive increase in concentration of persistent, fat-soluble pesticides, such as organochlorines, within organism tissues at successively higher trophic levels of food chains. Lower organisms absorb small environmental quantities, which accumulate increasingly in predators as energy transfers upward, potentially causing severe toxic effects in top-level predators and consumers.

34. (D) I, II and III
Post-harvest pesticide residue levels depend on multiple interacting factors. The chemical half-life dictates intrinsic breakdown rates, while application dosage and frequency determine initial deposit levels. Additionally, environmental conditions such as sunlight intensity, temperature, and rainfall accelerate chemical degradation processes, collectively determining the final persistent residue remaining on crop produce at harvest.

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35. (A) Parthenium or Carrot grass (Parthenium hysterophorus)
Zygogramma bicolorata, commonly known as the Mexican beetle, was introduced into India as a classical biological control agent against Parthenium hysterophorus, an invasive weed. Both adult beetles and larvae feed extensively on Parthenium foliage and flower buds, severely defoliating plants, suppressing seed production, and reducing weed density across infested lands.

36. (C) Azadirachtin
Azadirachtin is the primary active limonoid compound extracted from seeds of the neem tree, Azadirachta indica. It acts as a potent biological insecticide, functioning as an antifeedant, insect growth regulator, and oviposition deterrent. Azadirachtin disrupts ecdysone hormone levels in juvenile insects, preventing normal moulting

and development without presenting high mammalian toxicity.

37. (A) I, II and III only
The Insecticides Act of 1968 regulates pesticide importation, manufacturing, sale, distribution, and usage across India to protect humans and animals from toxicity hazards. Mandatory registration with the Central Insecticides Board and Registration Committee is required for all products. Licensing regulations strictly govern retail sales, making the fourth statement completely false regarding unregulated sales.

38. (D) Production of crystalline endotoxins causing midgut destruction upon ingestion
Bacillus thuringiensis produces crystalline protein delta-endotoxins during sporulation. When susceptible insect larvae ingest treated foliage, alkaline digestive fluids within the midgut dissolve these crystals, releasing toxic proteins. These proteins bind to midgut epithelial receptors, creating pores that disrupt osmotic balance, paralyze the digestive system, and cause larval mortality through starvation and septicemia.

39. (A) P-2, Q-4, R-1, S-3
Trichoderma viride suppresses soil-borne fungal pathogens causing root rot and wilt. Beauveria bassiana is an entomopathogenic fungus targeting soft-bodied sap-sucking insects. Bacillus thuringiensis produces crystalline toxins against lepidopteran caterpillars, while Pseudomonas fluorescens acts as a plant growth-promoting rhizobacterium that suppresses plant diseases and enhances root health across various crop species.

40. (C) Paraquat
Paraquat is a non-selective, contact herbicide widely utilized in zero-tillage farming for pre-sowing weed management. Upon application, it rapidly desiccates green plant tissues by disrupting photosynthesis and producing destructive superoxide radicals. Because it binds tightly to soil particles upon contact, paraquat leaves no toxic soil residues, allowing immediate crop planting.

41. (D) Sugarcane pyrilla
Epipyrops melanoleuca, also known as Fulgoraecia melanoleuca, is an ectoparasitoid nymph and moth species native to India. It serves as a highly effective biological control agent against the sugarcane leafhopper, Pyrilla perpusilla. Parasitoid larvae attach externally to pyrilla nymphs and adults, feeding on hemolymph and causing substantial pest mortality.

42. (A) Early shoot borer
Early shoot borer infestation in young sugarcane crops causes central shoot wilting, forming characteristic "dead hearts." These affected shoots emit an offensive rotten odor when pulled out and detach easily from the base. This early damage reduces tiller survival, directly affecting stand establishment and ultimate crop yields during early development stages.

43. (B) Dead heart formation with parallel rows of shot holes on emerging leaves
Sugarcane top borer larvae bore into shoot apexes, killing central growing points and creating dead hearts. As unrolling young leaves emerge from damaged whorls, distinct parallel rows of shot-hole perforations appear across leaf blades. Later larval feeding damages terminal buds, inducing lateral bud sprouting and producing a side shoot "bunchy top" appearance.

44. (B) Colletotrichum falcatum
Red rot, known as the "cancer of sugarcane," is caused by the fungal pathogen Colletotrichum falcatum. Infected internal stalk tissues display longitudinal red discoloration interrupted by diagnostic transverse white spots, accompanied by a distinct alcoholic sour smell. Severe infections cause stalk drying, canopy yellowing, lodging, and complete loss of sucrose content.

45. (A) Taking a ratoon crop
Ratooning sugarcane fields infected with red rot is strictly avoided because fungal pathogens persist in underground stubble and root systems. Raising ratoon crops in contaminated fields perpetuates primary disease inoculum, causing severe disease epidemics in subsequent seasons. Managing red rot requires removing infected stubbles, practicing crop rotation, and planting certified disease-free setts.

46. (C) Phytoplasma
Grassy shoot disease in sugarcane is caused by a phytoplasma pathogen. Affected plants produce numerous crowded, slender, chlorotic tillers with narrow leaves, giving stools a dense, grass-like clump appearance. The pathogen spreads

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primarily through infected planting setts and is transmitted between fields by insect vectors such as leafhoppers, causing severe yield reduction.

47. (A) II, IV, I, III
Sugarcane establishment begins with selecting disease-free seed cane from healthy nurseries. Stalks are cut into three-budded setts to ensure reliable germination. These setts undergo fungicide and insecticide treatments to protect against soil-borne pathogens and pests before being placed into prepared trenches or furrows and covered with soil for crop growth.

48. (C) Chlorpyrifos 20% EC
Chlorpyrifos twenty percent EC is an effective organophosphate insecticide applied directly over sugarcane setts placed in open furrows prior to soil covering. This soil application forms a protective chemical barrier around planting material, protecting vulnerable setts and emerging buds from subterranean termite attack and preventing early sett damage during germination.

49. (B) Contaminated field harvesting tools
Ratoon stunting disease is a major bacterial disease caused by Leifsonia xyli sub-species xyli. The pathogen infects vascular bundle tissues, causing stunted growth and yield declines. It is highly contagious and spreads mechanically across fields through contaminated harvesting cane knives, cutting equipment, and machinery during harvesting or sett preparation operations.

50. (D) Smut
Sugarcane smut, caused by Sporisorium scitamineum, is characterized by the production of an elongated, unbranched, whip-like structure emerging from the central shoot apex. Initially covered by a thin silver membrane, this structure ruptures to release millions of dark, dusty fungal teliospores, which spread rapidly via wind currents to infect adjacent sugarcane plants.

51. (A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
Trash mulching involves spreading dry sugarcane leaves across field inter-rows in ratoon crops. This organic mulch forms a physical barrier that blocks sunlight penetration, suppresses weed seed germination, conserves soil moisture, and moderates topsoil temperatures. Consequently, trash mulching serves as an effective cultural strategy for managing weeds in ratoon sugarcane systems.

52. (D) I, II and III
Integrated weed management in sugarcane combines multiple cultural operations. Autumn crops experience critical weed competition between sixty and one hundred twenty days. Blind hoeing before shoot emergence destroys germinating weed seedlings, while intercropping fast-growing pulse crops smothers weed growth, optimizes field space, and enhances soil fertility through biological nitrogen fixation.

53. (A) Atrazine
Atrazine is a selective triazine herbicide widely recommended for pre-emergence application in sugarcane crops. Applied shortly after planting, it is absorbed by roots and foliage of germinating weeds, inhibiting photosynthesis by blocking electron transport. It controls broadleaf weeds and annual grasses while demonstrating high safety tolerance in sugarcane crops.

54. (A) P-3, Q-2, R-4, S-1
Top borer larvae cause firm dead hearts and bunchy top growth, whereas early shoot borer creates foul-smelling dead hearts that pull out easily. Root borers cause yellowing and root zone galleries. Pyrilla nymphs and adults suck sap, secreting honeydew that promotes black sooty mould growth across affected foliage surfaces.

55. (B) 50°C for 2 to 2.5 hours
Hot water treatment at fifty degrees Celsius for two to two and a half hours is a established physical sanitation measure for sugarcane setts. This precise thermal exposure eliminates internal seed-borne pathogens, including smut fungi and grassy shoot phytoplasmas, without compromising bud viability, providing healthy seed material for nursery and field planting.

56. (C) High target specificity and slower speed of action relative to chemical pesticides
Biological control methods present operational limitations in field crop protection due to high target specificity and slow killing action compared to synthetic chemical pesticides. Biocontrol agents require favorable environmental conditions to establish, act gradually over time, and do not provide immediate knock-down mortality during severe pest outbreaks requiring rapid intervention.

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57. (D) Lowest pest population causing economic damage equal to control costs
Economic injury level is defined as the lowest pest population density that causes crop yield loss equal to the financial cost of implementing pest control operations. Maintaining pest populations below this theoretical baseline ensures that economic benefits derived from crop protection measures consistently outweigh control expenses incurred during farm management.

58. (A) In the early morning when dew is present on the leaves
Applying chemical dusts using agricultural dusters is most effective in early morning hours when foliage is wet with natural dew and atmospheric air currents are calm. Leaf dew helps fine chemical particles adhere tightly to plant surfaces, preventing powder bounce-off, while minimal wind reduces particle drift away from targeted crop canopies.

59. (B) Maintaining continuous, uniform spray discharge at the nozzle
The air chamber or pressure vessel in a manual knapsack sprayer compresses air during pump strokes. This compressed air cushions hydraulic pressure surges, maintaining continuous and uniform liquid discharge through the nozzle during operator pumping pauses. Consistent spray pressure ensures even droplet atomization and uniform pesticide application across treated foliage.

60. (B) Phenylamides (e.g., Metalaxyl)
Phenylamide fungicides, such as metalaxyl, are systemic chemical compounds highly active against Oomycetes pathogens causing downy mildews, late blights, and damp-off diseases. They inhibit fungal RNA polymerase synthesis, translocating through plant vascular tissues to provide curative and protective activity against soil-borne and foliar water-mould infections across various agricultural crops.

61. (A) Inhibiting acetylcholinesterase in the nervous system
Organophosphate insecticides, including malathion and chlorpyrifos, act as potent neurotoxins by inhibiting the enzyme acetylcholinesterase at nerve synapses. This inhibition leads to continuous accumulation of acetylcholine, causing uninterrupted nerve impulse transmission, severe muscular tremors, convulsions, functional paralysis, and ultimate death in exposed target insect pests.

62. (A) Green → Blue → Yellow → Red
Toxicity color codes on pesticide containers reflect safety levels based on toxicity data. Green represents slightly toxic formulations, blue signifies moderately toxic compounds, yellow denotes highly toxic chemicals, and red indicates extremely toxic substances. This standardized color gradient assists handlers in identifying hazards and applying appropriate safety protocols.

63. (D) Adoption of cultural practices and resistant varieties
Adopting sound cultural practices alongside crop varieties resistant to pests provides a foundational, environmentally safe strategy within integrated pest management systems. These long-term preventive measures alter crop microclimates, disrupt pest life cycles, suppress initial population build-up, and reduce reliance on synthetic chemical applications, fostering sustainable agricultural productivity without environmental degradation.

64. (C) Trichogramma chilonis
Trichogramma chilonis is an egg parasitoid mass-produced in commercial bio-laboratories on laboratory host eggs and distributed as paper tricho-cards. In sugarcane fields, released adult wasps locate and parasitoidize eggs of tissue-boring lepidopteran pests, preventing caterpillar emergence and reducing crop damage without leaving toxic residues or harming non-target organisms.

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65. (B) Disrupting synchronization between crop susceptible stages and peak pest emergence
Adjusting crop planting dates alters normal phenological timing to disrupt ecological synchronization between vulnerable crop growth stages and peak seasonal pest populations. Shifting planting times enables crops to pass susceptible growth phases before major pest emergence occurs, significantly escaping severe pest damage while reducing dependence on synthetic chemical interventions.

66. (D) Sucking insects like aphids, whiteflies, and jassids
Yellow sticky traps exploit the innate visual attraction of small sap-sucking insects to

specific yellow wavelengths. Flying adult aphids, whiteflies, jassids, and leafminers are drawn to bright yellow surfaces coated with non-drying adhesive, capturing them for continuous population monitoring, early detection, and mass trapping within integrated pest management programs.

67. (A) Conserve and build natural enemy populations (predators and parasitoids)
Maintaining flowering companion plants like marigold or cowpea along field borders provides alternative food resources, including nectar and pollen, alongside shelter for beneficial insects. These flowering refuges conserve and build local populations of predatory beetles, hoverflies, and parasitoid wasps, enhancing natural biological control mechanisms against insect pests within crop ecosystems.

68. (C) Broad-spectrum sprays destroy natural enemies that controlled minor pests
Secondary pest outbreaks occur when repeated applications of broad-spectrum chemical insecticides destroy native predatory and parasitic organisms alongside target primary pests. In the absence of natural biological control, previously non-damaging minor pest populations reproduce unchecked, rapidly expanding to reach economically damaging threshold levels within treated field crops.

69. (A) Remove contaminated clothing and wash skin thoroughly with soap and water
Immediate first aid for dermal pesticide exposure requires removing contaminated clothing quickly and washing exposed skin thoroughly with running water and gentle soap. Immediate washing removes chemical residues from skin surfaces, minimizing dermal absorption, reducing systemic toxicological risks, and preventing acute chemical burns prior to seeking professional medical assistance.

70. (D) Liquid discharge volume per unit time and field area
Sprayer calibration determines the precise volume of liquid discharge delivered per unit time across a defined field area under standard operating speed and pressure. Accurate calibration ensures recommended chemical dosages are applied uniformly, preventing economic waste, crop phytotoxicity from excessive chemical application, or ineffective pest suppression from under-dosage.

71. (A) I, II and III only
Safe pesticide management requires storing chemicals in original labeled containers within secure, locked rooms, and disposing of rinsed, punctured containers in safe locations. Discharging leftover chemical solutions into irrigation canals or water bodies causes severe environmental contamination, aquatic toxicity, and water pollution, making the fourth statement unsafe and incorrect.

72. (C) Toxicological animal feeding studies establishing the NOAEL threshold
Acceptable daily intake values represent safe daily exposure levels of chemical residues over a human lifespan without appreciable health risk. Toxicologists calculate this standard using the no observed adverse effect level derived from long-term animal toxicity studies, applying appropriate safety factors to account for interspecies and intraspecies biological variations.

73. (D) Nut sedge (Cyperus rotundus)
Halosulfuron-methyl is a selective sulfonylurea herbicide recommended for post-emergence application in sugarcane to manage purple nut sedge, Cyperus rotundus. It inhibits the acetolactate synthase enzyme, translocating into underground tubers and basal bulbs to suppress shoot growth and kill persistent perennial sedge propagules without damaging the crop.

74. (A) Trichoderma viride
Trichoderma viride is a beneficial soil-dwelling fungus widely utilized as a biological seed treatment and soil inoculant. It antagonizes soil-borne pathogenic fungi, including Fusarium, Rhizoctonia, and Pythium species, through mechanisms like mycoparasitism, enzyme production, nutrient competition, and induction of systemic resistance in host plants, preventing root rot diseases.

75. (B) Central Insecticides Board and Registration Committee (CIBRC)
The Central Insecticides Board and Registration Committee serves as the statutory national authority under the Insecticides Act of 1968. It advises central and state governments on technical regulatory issues, evaluates

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toxicological and bio-efficacy data, and grants mandatory product registrations to ensure safe pesticide manufacturing, import, sale, and use nationwide.

76. (B) Fusarium moniliforme (Fusarium sacchari)
Pokkah boeng is an important fungal disease of sugarcane caused by Fusarium moniliforme, also known as Fusarium sacchari. Diagnostic symptoms include malformed, twisted, wrinkled leaves, chlorotic leaf bases, and top rot in severe cases. Airborne fungal spores infect tender growing shoot tips during warm, humid monsoon conditions.

77. (A) Blind hoeing
Blind hoeing involves shallow soil cultivation performed after sugarcane planting but prior to shoot emergence. This cultural operation destroys early germinating weed seedlings, breaks surface soil crusts, improves soil aeration, and disrupts shelter conditions for early shoot borer moths, promoting uniform crop shoot emergence and early stand establishment.

78. (C) Prevents plant lodging and suppresses late-emerging weeds
Earthing up involves moving soil from inter-row furrows toward crop bases during early growth. In sugarcane management, this practice buries weed seedlings, suppresses late weed emergence, promotes adventitious root development, and provides structural anchorage to heavy cane stalks, preventing crop lodging caused by strong winds or rain late in seasons.

79. (D) I, II and III
Grassy shoot disease is caused by a phytoplasma pathogen. Primary transmission occurs through infected seed setts used during planting, while secondary field spread is driven by sap-sucking leafhopper vectors. Effective disease management requires using certified healthy planting setts, hot water treatment, removing infected clumps, and controlling vector insects.

80. (C) Pesticide residues exceeding MRL pose acute health risks to consumers
Harvesting crops shortly after applying systemic insecticides violates mandatory pre-harvest waiting periods, preventing chemical degradation. Consequently, harvested produce contains pesticide residues exceeding established maximum residue limits, creating severe acute and chronic health hazards for consumers due to toxic chemical ingestion through contaminated food items entering market chains.

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CHAPTER 07
Crop Pest and Disease Management

1. Which of the following is the most destructive disease of sugarcane in Uttar Pradesh, often referred to as the "cancer of sugarcane"?
(A) Sugarcane smut
(B) Red rot
(C) Grassy shoot disease
(D) Ratoon stunting disease

2. The causal organism of red rot in sugarcane is a fungus known as:
(A) Fusarium moniliforme
(B) Ustilago scitaminea
(C) Cercospora longipes
(D) Colletotrichum falcatum

3. Consider the following statements regarding termite damage in sugarcane:
I. Termites primarily attack the cane setts during the planting stage and root system in standing crops.
II. High soil moisture and frequent irrigation increase termite incidence in sugarcane fields.
III. Chlorpyrifos 20 EC or Imidacloprid can be used for soil or sett treatment to control termites.
Which of the above statement(s) is/are correct?
(A) I and III only
(B) I and II only
(C) II and III only
(D) I, II and III

4. A characteristic "whip-like" black structure emerging from the central whorl of the sugarcane plant is a typical visual symptom of which disease?
(A) Red rot
(B) Wilt
(C) Smut
(D) Pokkah Boeng

5. What is the standard recommended biological control agent used effectively against the sugarcane leafhopper (Pyrilla perpusilla) in Uttar Pradesh?
(A) Epiricania melanoleuca
(B) Trichogramma chilonis
(C) Chrysoperla carnea
(D) Beauveria bassiana

6. Read the given Assertion (A) and Reason (R) carefully and select the correct option.
Assertion (A): Sett treatment with fungicides like Carbendazim is an essential practice before planting sugarcane.
Reason (R): Sett treatment completely cures the setts that are internally infected with the red rot pathogen.
(A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
(B) Both Assertion (A) and Reason (R) are true but R is not the correct explanation of A.
(C) Assertion (A) is true but Reason (R) is false.
(D) Assertion (A) is false but Reason (R) is true.

7. "Dead heart" in sugarcane, which cannot be easily pulled out and does not emit a foul smell, is primarily caused by which pest?
(A) Early shoot borer
(B) Top borer
(C) Root borer
(D) Stalk borer

8. The scientific name of the white grub, a major polyphagous pest causing severe root damage in sugarcane and groundnut in sandy soils, is:
(A) Scirpophaga excerptalis
(B) Chilo infuscatellus
(C) Holotrichia consanguinea
(D) Odontotermes obesus

9. Match the sugarcane pests in List I with their characteristic damage symptoms in List II.
List I: (Sugarcane Pests)
P. Early shoot borer
Q. Root borer
R. Pyrilla
S. Scale insect
List II: (Damage Symptoms)
1. Yellowing of leaves and sooty mold development
2. Dead heart emitting a foul, offensive smell

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3. Encrustation on the stem internodes leading to shriveling
4. Dead heart which is not easily pulled out and no foul smell

(A) P-4, Q-2, R-3, S-1
(B) P-2, Q-3, R-1, S-4
(C) P-1, Q-4, R-2, S-3
(D) P-2, Q-4, R-1, S-3

10. The incidence of white grub in sugarcane fields is best managed by applying granular insecticides at which stage of the insect's life cycle?
(A) Upon adult emergence following pre-monsoon showers
(B) During pupal development deep within the soil profile
(C) During egg deposition in topsoil during early winter
(D) During adult overwintering hibernation in late autumn

11. In paddy, the symptom known as "white ear" or "white earhead" is caused by the attack of which pest during the reproductive stage?
(A) Gundhi bug
(B) Yellow stem borer
(C) Brown plant hopper
(D) Rice hispa

12. Which of the following is the causal organism for black rust or stem rust of wheat?
(A) Puccinia recondita
(B) Puccinia graminis tritici
(C) Puccinia striiformis
(D) Ustilago tritici

13. Which of the following statements is incorrect regarding the management of the rice leaf folder?
(A) High application of nitrogenous fertilizers reduces leaf folder incidence.
(B) Leaves are folded longitudinally and larvae feed inside on the green tissues.
(C) Trichogramma chilonis can be released as an effective egg parasitoid agent.
(D) Clipping of affected leaf tips helps in significantly reducing pest numbers.

14. Consider the following statements regarding major diseases of wheat:
I. Karnal bunt is caused by Tilletia indica and emits a rotten fish smell.
II. Loose smut is an externally seed-borne disease.
III. Yellow rust is most severe in the cooler northern hill and plain zones of India.
IV. Solar energy treatment of seeds is an effective cultural control for loose smut.

Which of the above statement(s) is/are correct?
(A) I, II and III
(B) II, III and IV
(C) I, III and IV
(D) I, II, III and IV

15. The "hopper burn" symptom in paddy fields, characterized by circular patches of drying and lodging plants, is typically caused by:
(A) Green leafhopper
(B) Whitebacked plant hopper
(C) Rice bug
(D) Brown plant hopper

16. Select the correct sequential order of the life cycle stages of a holometabolous crop pest (like a stem borer or fruit borer).
(A) Egg → Pupa → Larva → Adult
(B) Larva → Egg → Pupa → Adult
(C) Egg → Larva → Pupa → Adult
(D) Pupa → Egg → Larva → Adult

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17. The paddy gundhi bug (Leptocorisa acuta) primarily damages the crop by attacking the plant during which stage?
(A) Seedling stage
(B) Milking stage of the panicle
(C) Maximum tillering stage
(D) Maturity and harvesting stage

18. Identify the odd one out among the following pests based on the group of crops they primarily attack.
(A) Chilo partellus
(B) Scirpophaga incertulas
(C) Leptocorisa acuta
(D) Helicoverpa armigera

19. Read the given Assertion (A) and Reason (R) carefully and select the correct option.
Assertion (A): Sucking pests like whitefly and aphids are particularly dangerous to crops like papaya, tomato, and pulses.
Reason (R): Besides causing direct sap loss, they act as vectors for transmitting serious viral diseases.
(A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
(B) Both Assertion (A) and Reason (R) are true but R is not the correct explanation of A.
(C) Assertion (A) is true but Reason (R) is false.

(D) Assertion (A) is false but Reason (R) is true.

20. Tricho cards are highly recommended in sugarcane and paddy fields. These cards deploy Trichogramma species, which are:
(A) Larval parasitoids
(B) Pupal predators
(C) Egg parasitoids
(D) Fungal bio-pesticides

21. Which pest is considered the most devastating to pulse crops like chickpea (gram) and pigeonpea (arhar) in Uttar Pradesh?
(A) Gram pod borer
(B) Pigeonpea pod fly
(C) Arhar plume moth
(D) Surface cutworm

22. In mustard crops, the population of aphids usually peaks during which weather condition?
(A) Hot, dry, and windy weather during May
(B) Continuous heavy rainfall throughout August
(C) High humidity combined with high heat in July
(D) Cold and cloudy weather during Jan-Feb

23. The most effective, environmentally safe, and economical method to manage wilt disease (Fusarium udum) in pigeonpea (arhar) is:
(A) Heavy application of urea
(B) Use of wilt-resistant varieties
(C) Frequent deep plowing during winter
(D) Aerial spraying of contact fungicides

24. Consider the following statements regarding white rust in mustard:
I. It is caused by the fungus Albugo candida.
II. Characteristic white blisters appear on the leaves, stems, and inflorescence.
III. The disease only affects the roots and never spreads to the floral parts.
Which of the above statement(s) is/are correct?
(A) II and III only
(B) I and III only
(C) I and II only
(D) I, II and III

25. Match the major crops in List I with their most serious pests in List II.
List I: (Crops)
P. Mustard
Q. Brinjal
R. Tomato
S. Cabbage
List II: (Pests)
1. Diamondback moth
2. Shoot and fruit borer
3. Aphid
4. Fruit borer
(A) P-1, Q-2, R-3, S-4
(B) P-3, Q-4, R-2, S-1
(C) P-2, Q-3, R-1, S-4
(D) P-3, Q-2, R-4, S-1

26. Yellow vein mosaic of okra (bhindi) is a devastating viral disease. It is primarily transmitted in the field by:
(A) Whitefly
(B) Thrips
(C) Jassids
(D) Red cotton bug

27. Late blight of potato, the disease responsible for the historic Irish famine, is caused by:
(A) Alternaria solani
(B) Phytophthora infestans
(C) Fusarium oxysporum
(D) Rhizoctonia solani

28. Which of the following is an incorrect statement regarding the management of root-knot nematodes in vegetable crops?
(A) They cause characteristic galls or swellings on the root system.
(B) Growing marigold as an intercrop or rotation crop increases nematode incidence.
(C) Soil application of carbofuran helps in reducing nematode populations.
(D) Deep summer ploughing helps in exposing nematode cysts and juveniles to solar heat.

29. Identify the odd one out from the following plant diseases based on their causal agent.
(A) Sugarcane grassy shoot
(B) Sugarcane red rot disease
(C) Wheat black stem rust
(D) Rice leaf blast disease

30. Which trap crop is widely planted around tomato fields to attract the tomato fruit borer (Helicoverpa armigera) away from the main crop?
(A) Indian mustard
(B) Wild cabbage
(C) Marigold
(D) Field garlic

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31. Bacterial leaf blight of paddy, characterized by water-soaked to yellowish stripes along the leaf margins, is caused by:
(A) Pseudomonas syringae
(B) Erwinia amylovora
(C) Ralstonia solanacearum
(D) Xanthomonas oryzae

32. Fungicides that are absorbed by the plant foliage or roots and translocated within the plant system to protect it from internal infections are called:
(A) Non-systemic contact fungicides
(B) Surface protectant dusts
(C) Systemic fungicides
(D) Soil and vapor fumigants

33. Consider the following statements distinguishing fungal, bacterial, and viral crop diseases:
I. Fungal diseases often present visual signs like mycelium, powdery growth, or rust pustules.
II. Bacterial infections frequently show symptoms like water-soaking, oozing, and angular leaf spots.
III. Viral diseases generally cause stunting, mosaic patterns, and leaf curling, but do not produce visible spores or ooze.
IV. Viral diseases can be easily cured by applying contact fungicides to the affected leaves.
Which of the above statement(s) is/are correct?
(A) I, II and IV
(B) I, II and III
(C) I, III and IV
(D) II, III and IV

34. Read the given Assertion (A) and Reason (R) carefully and select the correct option.
Assertion (A): The primary management strategy for most viral diseases in crops is vector control rather than direct chemical application.
Reason (R): There are no commercial chemical virucides currently available for agricultural use that can cure a plant once infected by a virus.
(A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
(B) Both Assertion (A) and Reason (R) are true but R is not the correct explanation of A.
(C) Assertion (A) is true but Reason (R) is false.
(D) Assertion (A) is false but Reason (R) is true.

35. The disease symptom characterized by a localized loss of normal green coloration, leaving yellowish or white patches on the leaf, is known as:
(A) Chlorosis
(B) Necrosis
(C) Hypertrophy
(D) Hyperplasia

36. Arrange the following fundamental stages of a typical plant disease cycle in their correct chronological sequence:
1. Infection
2. Inoculation
3. Symptom expression
4. Penetration
(A) $2 \rightarrow 4 \rightarrow 1 \rightarrow 3$
(B) $4 \rightarrow 2 \rightarrow 1 \rightarrow 3$
(C) $2 \rightarrow 1 \rightarrow 4 \rightarrow 3$
(D) $1 \rightarrow 2 \rightarrow 4 \rightarrow 3$

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37. Which visual symptom accurately distinguishes powdery mildew from downy mildew in crops?
(A) Powdery mildew forms white growth on upper leaves, while downy mildew forms grayish growth mainly on lower leaves.
(B) Powdery mildew primarily attacks subterranean root systems, whereas downy mildew severely damages vascular stem tissues.
(C) Powdery mildew typically produces soft water-soaked lesions, whereas downy mildew creates dry necrotic foliage spots.
(D) Powdery mildew exclusively infects developing fruit structures, whereas downy mildew exclusively infects root tissues.

38. Identify the correct pair of a biological control agent and its primary target application.
(A) Pseudomonas fluorescens - Biological control of foliar leaf-eating caterpillars
(B) NPV (Nucleopolyhedrovirus) - Effective management of root-knot nematodes
(C) Bacillus thuringiensis - Curative management of systemic viral mosaics
(D) Trichoderma viride - Control of soil-borne fungal pathogens

39. What is the fundamental first step in any successful integrated pest and disease management program?
(A) Immediate spraying of a broad-spectrum chemical pesticide across the entire field
(B) Accurate pest or disease identification and understanding its life cycle
(C) Plucking and burning all visibly affected plants immediately from the field area
(D) Applying a heavy dose of nitrogen fertilizer to rapidly boost initial plant growth

40. Growing a non-host crop in sequence with a susceptible crop on the same piece of land to break the life cycle of a soil-borne pathogen or pest is called:
(A) Mixed cropping
(B) Trap cropping
(C) Crop rotation
(D) Relay cropping

41. Match the pesticide classes in List I with their respective examples in List II.
List I: (Pesticide Class)
P. Organophosphate
Q. Neonicotinoid
R. Synthetic Pyrethroid
S. Bio-pesticide
List II: (Example)
1. Imidacloprid
2. Cypermethrin
3. Chlorpyrifos
4. Beauveria bassiana
(A) P-1, Q-3, R-2, S-4
(B) P-3, Q-2, R-1, S-4
(C) P-2, Q-1, R-4, S-3
(D) P-3, Q-1, R-2, S-4

42. How does the biological agent Bacillus thuringiensis (Bt) kill susceptible insect pests?
(A) It acts as a stomach poison, rupturing the insect midgut with protein crystals.
(B) It suffocates the target insect pest by physically blocking its respiratory spiracles.
(C) It paralyzes the central nervous system instantly upon direct contact with the cuticle.
(D) It rapidly absorbs moisture from the insect's body, causing fatal osmotic dehydration.

43. Which of the following is considered an environmentally friendly pest control method that relies on chemical signals to disrupt the mating behavior of insects?
(A) Systemic insecticides
(B) Pheromone traps
(C) Weedicides
(D) Contact fungicides

44. Consider the following statements regarding Integrated Pest Management (IPM):
I. IPM completely eliminates the use of all chemical pesticides under all circumstances.
II. IPM combines cultural, mechanical, biological, and chemical methods in a compatible manner.
III. Chemical pesticides in an IPM program are used only as a last resort when pest population crosses the ETL.
Which of the above statement(s) is/are correct?
(A) I and II only
(B) II and III only
(C) I and III only
(D) I, II and III

45. On a pesticide container, a bright green colored triangle on the label indicates that the chemical is:
(A) Slightly toxic
(B) Extremely toxic
(C) Highly toxic
(D) Moderately toxic

46. Which of the following statements about the use of disease-resistant crop varieties is incorrect?
(A) Cultivating resistant varieties significantly reduces the financial cost of chemical fungicides.
(B) Resistance mechanism is often highly specific to a particular pathogen race or strain.
(C) A regional resistant variety remains permanently resistant across all environments.
(D) Effective use of disease-resistant varieties forms a core structural component of IPM.

47. Which of the following is the odd one out in the context of disease management?
(A) Mancozeb
(B) Carbendazim
(C) Copper oxychloride
(D) Trichoderma harzianum

48. In biological control, the ladybird beetle (Coccinellidae) is highly valued because it acts as an active predator of:
(A) Stem borers
(B) Nematodes
(C) Aphids
(D) White grubs

49. For the prevention of seed-borne and early soil-borne diseases, seeds are generally treated with a specific sequence of components. The correct standard sequence for seed treatment is:
(A) Insecticide, then Fungicide, then Rhizobium culture
(B) Fungicide, then Insecticide, then Rhizobium culture
(C) Rhizobium culture, then Fungicide, then

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Insecticide
(D) Fungicide, then Rhizobium culture, then Insecticide

50. Read the given Assertion (A) and Reason (R) carefully and select the correct option.
Assertion (A): Deep summer ploughing is highly recommended for pest and disease management in northern India.
Reason (R): It exposes the resting stages of insects (pupae), soil-borne pathogens, and nematode cysts to intense solar radiation and natural predators.
(A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
(B) Both Assertion (A) and Reason (R) are true but R is not the correct explanation of A.
(C) Assertion (A) is true but Reason (R) is false.
(D) Assertion (A) is false but Reason (R) is true.

51. The Economic Threshold Level (ETL) in pest management is defined as:
(A) The pest density at which control measures must prevent populations from reaching the economic injury level.
(B) The maximum pest population level at which the standing crop suffers total death and complete destruction.
(C) The absolute lowest baseline pest population density that is capable of causing measurable economic damage.
(D) The specific pest population density at which the total financial cost of control equals crop economic yield.

52. Which storage pest specifically attacks the germ (embryo) portion of the grain, turning it into flour, and is particularly problematic in wheat storehouses?
(A) Rice weevil
(B) Angoumois grain moth
(C) Khapra beetle
(D) Pulse beetle

53. Match the storage pests in List I with their scientific names in List II.
List I: (Storage Pest)
P. Rice weevil
Q. Pulse beetle
R. Lesser grain borer
S. Khapra beetle
List II: (Scientific Name)
1. Callosobruchus chinensis
2. Sitophilus oryzae
3. Trogoderma granarium
4. Rhizopertha dominica
(A) P-2, Q-1, R-4, S-3
(B) P-1, Q-2, R-3, S-4
(C) P-4, Q-3, R-2, S-1
(D) P-2, Q-4, R-1, S-3

54. For the safe storage of cereal grains like wheat and paddy to prevent insect and fungal damage, the grain moisture content should generally be brought down to:
(A) 2-4%
(B) 10-12%
(C) 16-18%
(D) 20-22%

55. Consider the following statements regarding pest survey and forecasting systems:
I. Surveys help in determining the geographical distribution and severity of a pest.
II. Light traps and pheromone traps are vital tools for monitoring insect pest populations.
III. Short-range forecasting predicts pest outbreaks purely on historical data without current weather inputs.
IV. Weather data like temperature and relative humidity play a crucial role in predicting disease epidemics like blight.
Which of the above statement(s) is/are correct?
(A) I, II and III
(B) I, II and IV
(C) II, III and IV
(D) I, III and IV

56. Select the correct order of pest population parameters arranged from the lowest population density to the highest density.
(A) General Equilibrium Position (GEP) → Economic Threshold Level (ETL) → Economic Injury Level (EIL)
(B) Economic Threshold Level (ETL) → General Equilibrium Position (GEP) → Economic Injury Level (EIL)
(C) Economic Injury Level (EIL) → Economic Threshold Level (ETL) → General Equilibrium Position (GEP)
(D) General Equilibrium Position (GEP) → Economic Injury Level (EIL) → Economic Threshold Level (ETL)

57. Which chemical is the most commonly used fumigant for the control of storage pests in grain warehouses and silos?
(A) Malathion liquid emulsifiable concentrate

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(B) Hydrated copper sulphate
(C) Granular zinc phosphide
(D) Aluminium phosphide

58. Identify the odd one out based on the feeding habits of storage pests (Primary vs Secondary pest).
(A) Red rust flour beetle (Tribolium castaneum)
(B) Rice weevil (Sitophilus oryzae)
(C) Khapra beetle (Trogoderma granarium)
(D) Lesser grain borer (Rhizopertha dominica)

59. Soil solarization is a technique primarily used in nurseries for the control of soil-borne pathogens, nematodes, and weeds. It involves:
(A) Burning dried crop residues uniformly across the soil surface prior to crop sowing.
(B) Covering moist soil with transparent polyethylene sheets during peak summer.
(C) Spraying broad-spectrum chemical herbicides over fields during peak daylight hours.
(D) Applying heavy doses of synthetic nitrogen fertilizers directly under high sunlight.

60. The "Ear cockle" disease of wheat, which causes grains to be replaced by hard, dark galls, is caused by:
(A) A pathogenic fungus
(B) A nematode
(C) A plant bacterium
(D) A plant virus

61. Which of the following is a classic symptom of root-knot nematode (Meloidogyne spp.) damage in vegetable crops?
(A) Profuse formation of galls or nodules on root systems
(B) Formation of numerous tiny aerial tubers along the main plant stem.
(C) Rapid foliage greening combined with excessive vegetative growth.
(D) Continuous exudation of a thick milky sap from damaged main roots.

62. Which pest is famously known to act as an obligate vector for transmitting the Yellow Vein Mosaic Virus (YVMV) in okra?
(A) Thrips tabaci
(B) Amrasca biguttula biguttula (Jassid)
(C) Bemisia tabaci (Whitefly)
(D) Aphis gossypii (Aphid)

63. Consider the following statements about Plant Quarantine:
I. The main objective of plant quarantine is to prevent the entry and spread of exotic pests and diseases into new regions.
II. In India, plant quarantine regulations are enforced under the Destructive Insects and Pests (DIP) Act, 1914.
III. Plant quarantine measures are only applied to international imports and never to domestic movement between states.
Which of the above statement(s) is/are correct?
(A) II and III only
(B) I and III only
(C) I, II and III
(D) I and II only

64. The Directorate of Plant Protection, Quarantine and Storage (DPPQS), which oversees the implementation of plant quarantine laws in India, is headquartered at:
(A) New Delhi
(B) Hyderabad
(C) Faridabad
(D) Lucknow

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65. Which of the following is an incorrect statement regarding the modern use of agricultural drones for pesticide application?
(A) Drones reduce the direct exposure of farm laborers to hazardous chemicals.
(B) Drones can operate effectively regardless of extremely high wind speeds and heavy rainfall.
(C) Drones ensure better coverage and penetration of the chemical canopy using low spray volumes.
(D) Drone spraying utilizes Ultra Low Volume (ULV) technology to save water and chemicals.

66. For effective regular field inspection and pest scouting, a field worker is generally advised to walk through the crop field in which specific pattern to ensure representative sampling?
(A) A straight line along one border
(B) A strict circle along the outer boundary
(C) Walking only through the center row
(D) A 'W' or 'X' shaped zigzag pattern

67. Weather-based pest and disease forecasting depends heavily on meteorological parameters. An outbreak of late blight in potato is highly probable when there is:
(A) Low temperature (12-15°C) with high relative humidity (>90%)
(B) Sustained high atmospheric temperatures

combined with low relative humidity.
(C) Prolonged periods of continuous dry weather and elevated wind speed.
(D) Extremely high ambient temperatures above 40°C paired with bright direct sunlight.

68. Identify the correct pair of a vector insect and the major viral disease it transmits in crops.
(A) Aphid vector - Papaya leaf curl virus
(B) Thrips vector - Sugarcane mosaic virus
(C) Whitefly - Mungbean yellow mosaic virus
(D) Leafhopper vector - Cucumber mosaic virus

69. In sugarcane, the disease "Grassy Shoot" is characterized by the production of numerous tillers with narrow, chlorotic leaves, making the plant look like a bunch of grass. What is the causal agent?
(A) Phytoplasma
(B) Soil-borne fungus
(C) Infectious viroid
(D) Plant parasitic nematode

70. The natural transmission of Sugarcane Grassy Shoot disease from one plant to another in the field is carried out by:
(A) Subterranean soil-borne fungi
(B) Plant parasitic nematodes
(C) Subterranean termites
(D) Leafhoppers / Aphids

71. A crucial integrated management strategy for ratoon stunting disease (RSD) and grassy shoot disease in sugarcane relies on a specific physical treatment of the seed cane (setts). What is it?
(A) Prolonged soaking of setts in concentrated urea fertilizer solution for 24 hours
(B) Moist Hot Air Treatment (MHAT) of setts at 54°C for 2-2.5 hours
(C) Deep freezing seed setts at negative 5°C temperatures for over 1 hour
(D) Exposing seed setts directly to intense summer sunlight for 7 consecutive days

72. Ratoon stunting disease (RSD) in sugarcane, which causes thin canes with short internodes and reddish-orange vascular bundles at the nodes, is caused by:
(A) A fungus (Fusarium sacchari)
(B) A virus (Sugarcane mosaic virus)
(C) A fastidious bacterium (Leifsonia xyli)
(D) A viroid

73. Pokkah Boeng disease in sugarcane is characterized by chlorotic patches, distorted, wrinkled leaves, and sometimes a "knife-cut" symptom on the stalk. The causal organism for this disease is:
(A) Ustilago scitaminea
(B) Xanthomonas albilineans
(C) Colletotrichum falcatum
(D) Fusarium moniliforme

74. Which of the following statements is incorrect regarding the integrated pest management of early shoot borer in sugarcane?
(A) Heavy nitrogen fertilization right after planting completely prevents borer attack.
(B) Spreading trash mulch evenly between cane rows significantly suppresses borer damage.
(C) Frequent, light field irrigations during hot summer months help reduce borer attack.
(D) Intercropping sugarcane with spice crops like coriander or garlic reduces borer incidence.

75. Sugarcane pyrilla causes severe damage during outbreaks. Which of the following is a classic symptom of severe pyrilla infestation?
(A) Formation of large bore holes inside the main stalk accompanied by frass accumulation
(B) Honeydew secretion on leaves causing sooty mold and lower photosynthesis
(C) Severe subterranean root decay causing sudden lodging and collapse of the crop canopy
(D) Emergence of a long black whip-like fungal structure from the central plant apex

76. In an integrated pest management program for sugarcane, tying (propping) the cane stalks together in the later stages of crop growth (August-September) is primarily done to prevent lodging. However, it also significantly helps in reducing the damage caused by which vertebrate and insect pests?
(A) Subterranean termites and white grubs
(B) Rats, jackals, and stalk borer
(C) Early shoot borer and sugarcane pyrilla
(D) Sugarcane root borer and plant nematodes

77. Identify the odd one out based on the part of the sugarcane plant primarily damaged by the pest.
(A) Top borer
(B) Termite
(C) White grub
(D) Root borer

78. When applying chemical pesticides in a standing crop using a knapsack sprayer, which type of

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nozzle is highly recommended for achieving a fine, even spray of herbicides, and which for insecticides/fungicides?

(A) Hollow cone nozzle for herbicides, flat fan nozzle for insecticides/fungicides

(B) Solid cone spray nozzle for all herbicides, adjustable high-pressure nozzle for insecticides

(C) Flat fan nozzle for herbicides, hollow cone nozzle for insecticides/fungicides

(D) Both chemical applications rely exclusively on wide-angle flood jet nozzles only

79. The biological control of sugarcane top borer (Scirpophaga excerptalis) is most effectively achieved by the mass release of which egg parasitoid?

(A) Tetrastichus howardi

(B) Trichogramma chilonis

(C) Isotima javensis

(D) Trichogramma japonicum

80. The sugarcane stalk borer (Chilo auricilius) causes significant damage in the tarai and central belts of Uttar Pradesh. When is the most critical period for its attack and population build-up in the field?

(A) During early seed germination and seedling emergence phase in March-April

(B) During peak summer heat accompanied by hot winds in May and June

(C) During the monsoon and post-monsoon period from July to October

(D) During late dormancy during cold winter months from December to January

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ANSWERS

1. (B) Red rot
Red rot is widely recognized as the most destructive fungal disease affecting sugarcane crops in Uttar Pradesh, earning the designation of sugarcane cancer. It causes severe internal vascular tissue reddening, stalk drying, and massive yield decline. The disease rapidly spreads through infected seed setts and irrigation water, leading to total crop failure in susceptible varieties.

2. (D) Colletotrichum falcatum
Colletotrichum falcatum is the anamorphic fungal pathogen responsible for red rot in sugarcane crops. This pathogen infects the vascular system of the cane stalk, leading to characteristic red lesions with white transverse spots. Primary infection occurs through infected seed setts, whereas secondary dispersal takes place via rain splashes, wind currents, and contaminated irrigation water in fields.

3. (A) I and III only
Termites attack planted sugarcane setts and root systems, causing poor germination and plant wilting. Unlike moisture-loving pests, termite incidence increases under dry soil conditions and prolonged drought, while frequent irrigation reduces their activity. Effective chemical management involves treating planting setts or soil with insecticides such as chlorpyrifos 20 EC or imidacloprid prior to planting crops.

4. (C) Smut
Sugarcane smut, caused by Sporisorium scitamineum, presents a distinct visual diagnostic symptom in the form of a long, unbranched, whip-like black structure arising from the central growing point of the plant shoot. This black whip is covered by a thin silvery membrane that ruptures to release millions of microscopic, wind-borne dark fungal teliospores into surrounding areas.

5. (A) Epiricania melanoleuca
Epiricania melanoleuca is an ectoparasitoid nymphal and adult parasite used for suppressing populations of the sugarcane leafhopper, Pyrilla perpusilla. The female parasite lays eggs on sugarcane leaves, and emerging larvae attach themselves to the abdomen of pyrilla nymphs and adults, feeding on their hemolymph and ultimately causing death, providing effective eco-friendly biological control in fields.

6. (C) Assertion (A) is true but Reason (R) is false.
Sett treatment using systemic fungicides like carbendazim is an essential preventive practice prior to planting sugarcane setts, protecting them against surface-borne fungal spores and soil-borne pathogens. However, chemical sett treatments only eliminate external contamination and cannot cure or eradicate internal mycelial infections of red rot pathogen already established deep within infected plant tissues.

7. (B) Top borer
Top borer larvae tunnel into the central shoot of sugarcane plants, killing the growing point and forming a dead heart structure. This dead heart remains tightly held inside the central leaf sheath and cannot be easily pulled out, nor does it produce any foul odor, distinguishing it from early shoot borer damage symptoms.

8. (C) Holotrichia consanguinea
Holotrichia consanguinea is the scientific name of the white grub, a polyphagous subterranean insect pest widely distributed in sandy and light soils. The fleshy C-shaped grubs feed extensively on underground roots of host crops including sugarcane, groundnut, and pulses, resulting in severe plant yellowing, wilting, lodging, and significant yield loss across fields.

9. (D) P-2, Q-4, R-1, S-3
Early shoot borer larvae create dead hearts emitting a foul smell that can be easily pulled out. Root borer produces dead hearts that cannot be pulled out easily and lack offensive odor. Pyrilla nymphs suck sap, excreting honeydew that fosters sooty mold. Scale insects encrust internodes, causing cane shriveling and sugar reduction.

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10. (A) Upon adult emergence following pre-monsoon showers
White grub adults emerge from the soil after first pre-monsoon showers in early summer to mate and lay eggs on trees. Soil application of granular insecticides or targeting adult beetles during this emergence phase breaks their life cycle, preventing grubs from hatching and damaging crop root systems during the main growing season.

11. (B) Yellow stem borer
The yellow stem borer larva bores into paddy tillers during the flowering and panicle initiation stages, feeding internally on stem tissues and cutting off nutrient transport. This causes complete drying and bleaching of the panicles, turning them completely white and empty, a classic symptom known as white ear or white earhead.

12. (B) Puccinia graminis tritici
Puccinia graminis tritici is the macrocyclic macro-heteroecious macro-fungal pathogen that causes black rust or stem rust in wheat. The fungus attacks stem internodes and leaf sheaths, producing elongated, reddish-brown pustules that later turn black as teleutospores develop, severely disrupting water and nutrient transport in host plants and reducing overall yield.

13. (A) High application of nitrogenous fertilizers reduces leaf folder incidence.
High application of nitrogenous fertilizers creates lush green succulent foliage that strongly attracts egg-laying adult rice leaf folder moths, thereby increasing pest population and damage levels. Larvae roll leaves longitudinally with silk threads and scrape green chlorophyll content internally. Trichogramma egg parasitoids and removing infested leaf tips help suppress population levels.

14. (C) I, III and IV
Karnal bunt, caused by Tilletia indica, produces trimethylamine emitting a distinct rotten fish odor. Yellow rust thrives in cool northern zones. Solar energy treatment effectively eliminates internal seed-borne mycelium of loose smut fungus. Loose smut is internally seed-borne, not externally, making fungicide seed soaking or solar drying necessary for control.

15. (D) Brown plant hopper
Nymphs and adults of the brown plant hopper gather at the base of rice tillers and suck plant sap, injecting toxic salivary secretions. Heavy feeding causes extensive leaf yellowing, rapid drying, and crop lodging in distinctive circular patches across flooded fields, a characteristic visual symptom commonly referred to as hopper burn.

16. (C) Egg → Larva → Pupa → Adult
Holometabolous insects undergo complete metamorphosis comprising four distinct life stages: egg, larva, pupa, and adult. The lifecycle begins when laid eggs hatch into actively feeding larvae, which grow through instar stages before transforming into resting pupae. During the pupal stage, internal tissue reorganization occurs, leading to the emergence of mature adults.

17. (B) Milking stage of the panicle
The paddy gundhi bug attacks rice crops specifically during the milky grain development stage. Both adult bugs and nymphs pierce soft developing grains using sucking mouthparts to feed on liquid endosperm. This results in empty or partially filled, discolored chaffy grains, emitting a foul bug odor throughout infested paddy fields.

18. (D) Helicoverpa armigera
Chilo partellus, Scirpophaga incertulas, and Leptocorisa acuta are major pests predominantly infesting monocotyledonous cereal crops such as rice, maize, and sorghum. In contrast, Helicoverpa armigera is a highly polyphagous pest that primarily damages dicotyledonous crops, including pulses like chickpea, pigeonpea, cotton, tomato, and oilseeds, causing destructive fruit and pod damage.

19. (A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
Sucking insects like whiteflies and aphids pose extreme danger to agricultural crops because, beyond direct sap removal that weakens plants, they serve as biological vectors for plant viruses. They transmit devastating diseases such as leaf curl and mosaic viruses, where controlling the vector population represents the primary method to prevent disease spread.

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20. (C) Egg parasitoids
Tricho cards contain parasitized host eggs carrying larvae of Trichogramma species, which are micro-hymenopteran egg parasitoids. When released in crop fields, adult wasps search for pest eggs laid by stem borers or leaf folders, inserting their own eggs inside them, which destroys the pest embryo before larvae can emerge and damage crops.

21. (A) Gram pod borer
The gram pod borer, Helicoverpa armigera, is the most destructive polyphagous pest affecting pulse crops like chickpea and pigeonpea. Caterpillars feed on tender leaves, flowers, and bore into developing pods, consuming seeds while keeping their hind body parts outside the pod, causing extensive yield reduction and economic loss across farming regions.

22. (D) Cold and cloudy weather during Jan-Feb
Mustard aphid, Lipaphis erysimi, multiplies rapidly under low ambient temperatures, high relative humidity, and cloudy or foggy weather during January and February. Nymphs and adults suck cell sap from leaves, inflorescences, and young pods, causing leaf curling, stunted growth, sooty mold development, and severe reduction in seed yield and oil quality.

23. (B) Use of wilt-resistant varieties
Pigeonpea wilt, caused by Fusarium udum, is a vascular soil-borne fungal disease that survives long in soil and inside root debris. Chemical applications and soil treatments are generally ineffective or economically non-viable. Sowing resistant crop varieties provides long-term, eco-friendly, and cost-effective management against vascular wilt pathogen infections in farming fields.

24. (C) I and II only
White rust in mustard, caused by Albugo candida, manifests as white to cream-colored pustules on leaves and stems. Severe infection causes hypertrophy and hyperplasia of floral organs, leading to staghead malformations. The disease is systemic and airborne, affecting all above-ground plant tissues including stems and inflorescence, rather than root systems.

25. (D) P-3, Q-2, R-4, S-1
Mustard aphid sucks sap from tender shoots, causing leaves to curl and wither. Brinjal shoot and fruit borer causes twig wilting and fruit damage. Tomato fruit borer bores into fruits, destroying commercial pulp value. Diamondback moth is a serious pest of brassica crops like cabbage, defoliating plants through caterpillar feeding.

26. (A) Whitefly
Yellow vein mosaic of okra is a severe viral disease caused by a Begomovirus pathogen. The virus is transmitted persistently by the whitefly vector, Bemisia tabaci. Infected plants exhibit striking yellowing of vein tissues, leaf chlorosis, stunted growth, and undersized yellow fruits, leading to substantial crop yield losses in commercial vegetable fields.

27. (B) Phytophthora infestans
Late blight of potato is caused by Phytophthora infestans, an oomycete pathogen responsible for the historic Irish potato famine during the 1840s. The pathogen causes irregular water-soaked purplish-black foliage lesions with white fungal growth on leaf undersides and tuber rot under cool, humid weather conditions, rapidly destroying entire standing crops.

28. (B) Growing marigold as an intercrop or rotation crop increases nematode incidence.
Marigold roots exude nematicidal compounds like alpha-terthienyl that effectively suppress and reduce root-knot nematode populations in soil. Therefore, growing marigold as an intercrop or rotation crop decreases, rather than increases, nematode infestation. Combining crop rotation with deep summer ploughing and nematicide application provides effective root-knot nematode management in vegetable farming fields.

29. (A) Sugarcane grassy shoot
Sugarcane grassy shoot is caused by a phytoplasma, a wall-less prokaryotic microorganism belonging to Mollicutes, transmitted primarily by insect vectors. In contrast, sugarcane red rot, wheat black stem rust, and rice blast are all fungal diseases caused by distinct fungal pathogens, making grassy shoot disease unique in terms of causal pathogen taxonomy.

30. (C) Marigold
Marigold is widely cultivated as a trap crop around tomato fields to manage Helicoverpa armigera. Marigold flowers attract adult female moths to lay eggs preferentially on marigold

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blossoms rather than main tomato crops. The pest larvae on trap plants are then easily destroyed using targeted biological or localized selective chemical spray treatments.

31. (D) Xanthomonas oryzae
Bacterial leaf blight of paddy is caused by the bacterial pathogen Xanthomonas oryzae pv. oryzae. The disease produces yellow to white wavy lesions along leaf margins, which coalesce into extensive leaf wilting and drying known as kresek phase in young plants, drastically reducing photosynthetic capacity and total crop grain yields.

32. (C) Systemic fungicides
Systemic fungicides are specialized chemical compounds absorbed by plant roots, foliage, or seeds and translocated vascularly throughout internal tissues. Unlike contact fungicides that remain on leaf surfaces, systemic fungicides eliminate established internal pathogens and protect newly formed plant growth, providing effective preventive and curative action against destructive fungal infections in agricultural crops.

33. (B) I, II and III
Fungi produce diagnostic signs like spores, rusts, and powdery growths. Bacteria cause water-soaked spots and bacterial ooze. Viruses induce systemic symptoms like chlorosis, mosaics, and leaf curling without forming surface spores. Plant viruses cannot be cured using contact fungicides, as chemical fungicides target fungal cell structures rather than sub-microscopic viral particles.

34. (A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
Viral plant diseases cannot be cured using direct chemical sprays because effective virucidal chemicals for agricultural plants do not exist. Once inside plant cells, viruses replicate systemically. Managing vector insect populations through sprays, traps, and resistant crop varieties represents the primary practical field strategy to control viral crop disease dissemination.

35. (A) Chlorosis
Chlorosis is the abnormal yellowing or whitening of plant foliage resulting from chlorophyll breakdown or failure in chlorophyll synthesis. It occurs due to nutrient deficiencies, pathogen infections, or environmental stress. In contrast, necrosis refers to plant tissue death, hypertrophy is organ enlargement, and hyperplasia represents abnormal cell division in host plant tissues.

36. (A) $2 \rightarrow 4 \rightarrow 1 \rightarrow 3$
A plant disease cycle follows a chronological progression beginning with inoculation, where the pathogen contact occurs on host tissue. Next, penetration happens as the pathogen enters host surfaces directly or via openings. Infection follows as host-pathogen parasitic relationship establishes, culminating in symptom expression as visible structural or physiological plant changes.

37. (A) Powdery mildew forms white growth on upper leaves, while downy mildew forms grayish growth mainly on lower leaves.
Powdery mildew fungal pathogens develop ectoparasitically, forming white powdery mats visible primarily on upper surfaces of host leaves and tender shoots. In contrast, downy mildew fungi develop endoparasitically, producing grayish or purplish downy growth predominantly on lower leaf surfaces, corresponding to chlorotic lesions present on upper leaf surfaces in field crops.

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38. (D) Trichoderma viride - Control of soil-borne fungal pathogens
Trichoderma viride is a beneficial soil-borne antagonist fungus widely utilized as a biological control agent against destructive plant pathogens. It operates through hyperparasitism, antibiosis, and competition, suppressing soil-borne fungal diseases such as root rot, damping-off, collar rot, and wilt caused by Rhizoctonia, Pythium, Sclerotium, and Fusarium species in agricultural crops.

39. (B) Accurate pest or disease identification and understanding its life cycle
The fundamental baseline step in executing an effective Integrated Pest Management program is accurate identification of the pest or pathogen alongside understanding its biology and lifecycle. Precise identification prevents misapplication of control measures, enabling farmers to select ecologically sound, targeted intervention strategies at the most vulnerable stage of the pest.

40. (C) Crop rotation
Crop rotation is a cultural management practice where non-host plant species are systematically grown in sequence with host crops on the same field over successive seasons. Alternating non-host crops starves soil-borne pathogens, parasitic nematodes, and host-specific insects, breaking their life cycle and effectively suppressing soil inoculum buildup without chemical reliance.

41. (D) P-3, Q-1, R-2, S-4
Chlorpyrifos belongs to the organophosphate class of insecticides targeting acetylcholinesterase in insect pests. Imidacloprid is a systemic neonicotinoid acting on nicotinic acetylcholine receptors. Cypermethrin represents a synthetic pyrethroid affecting nerve sodium channels. Beauveria bassiana is an entomopathogenic bio-pesticide fungus used for eco-friendly biological suppression of various susceptible insect pests in field crops.

42. (A) It acts as a stomach poison, rupturing the insect midgut with protein crystals.
Bacillus thuringiensis bacterium produces crystalline delta-endotoxin protein crystals during sporulation. When ingested by susceptible insect larvae, the alkaline environment of the insect midgut dissolves these crystals, releasing pore-forming endotoxins that lyse midgut epithelial cells. This ruptures the digestive tract wall, causing gut paralysis, starvation, and ultimate targeted insect death in crops.

43. (B) Pheromone traps
Pheromone traps use synthetic chemical sex pheromones that mimic natural chemical signals released by female insects to attract males. Disruption of natural communication suppresses successful mating and helps monitor pest population densities. This eco-friendly pest management technique leaves no toxic chemical residue on crops and maintains overall ecological field safety.

44. (B) II and III only
Integrated Pest Management is a holistic strategy combining cultural, biological, physical, and chemical control tools to keep pest populations below damage thresholds. IPM does not eliminate chemical pesticide use entirely; rather, chemical insecticides are applied selectively as a last resort only when pest densities exceed the established Economic Threshold Level.

45. (A) Slightly toxic
Pesticide containers display color-coded toxicity triangles to indicate chemical hazard levels. Red signifies extremely toxic, yellow indicates highly toxic, blue denotes moderately toxic, and bright green designates slightly toxic substances. These standardized visual warning labels assist farm workers in adopting appropriate safety measures during chemical storage and field crop application.

46. (C) A regional resistant variety remains permanently resistant across all environments.
Disease resistance in crop varieties is not permanent across all environments. Pathogen populations undergo mutations and evolution, leading to new virulent races that overcome host resistance over time. Environmental factors also influence resistance gene expression, making permanent environmental resistance unrealistic, necessitating continuous breeding of newly resistant crop cultivars for fields.

47. (D) Trichoderma harzianum
Mancozeb, carbendazim, and copper oxychloride are synthetic chemical fungicides manufactured for controlling plant pathogens. In contrast, Trichoderma harzianum is a living biological control agent, specifically an antagonistic fungus used to suppress soil-borne plant diseases through natural biological mechanisms rather than synthetic chemical toxicity, making it functionally distinct among chemical alternatives.

48. (C) Aphids
Ladybird beetles (family Coccinellidae) are major predatory insects in agricultural ecosystems. Both adult beetles and larval stages feed voraciously on soft-bodied plant sucking pests, particularly aphids, scale insects, and mealybugs. Deploying or conserving ladybird beetle populations provides effective biological control, suppressing pest outbreaks without relying on synthetic chemical pesticide sprays.

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49. (B) Fungicide, then Insecticide, then Rhizobium culture
Seed treatment follows the standard sequential rule designated as FIR: Fungicide first, Insecticide second, and Rhizobium culture last. Fungicide application protects seeds from seed-borne and soil-borne fungal pathogens. Insecticides protect emerging seedlings from soil pests. Rhizobium

biofertilizers are applied last to ensure bacterial cell survival for nodulation in leguminous crops.

50. (A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
Deep summer ploughing during hot summer months exposes subterranean resting stages of insect pests, soil-borne fungal propagules, weed seeds, and nematode cysts to intense solar radiation and high temperatures. Physical exposure combined with predation by birds significantly reduces soil pathogen loads and pest inoculum before sowing subsequent crops in fields.

51. (A) The pest density at which control measures must prevent populations from reaching the economic injury level.
Economic Threshold Level is the pest population density at which action must be taken to prevent pest numbers from reaching Economic Injury Level, where yield loss exceeds treatment cost. Initiating control measures at ETL ensures economic safety by intervening before crop loss occurs, providing a fundamental operational decision tool in IPM.

52. (C) Khapra beetle
The Khapra beetle, Trogoderma granarium, is a highly destructive primary storage pest in grain storehouses. Larvae specifically prefer feeding on the embryo or germ portion of stored cereal grains like wheat, hollowing them out into powdery flour. It exhibits high resistance to cold and dry conditions, making management critical in stored grains.

53. (A) P-2, Q-1, R-4, S-3
Sitophilus oryzae is the scientific name for the rice weevil, which attacks cereal grains. Callosobruchus chinensis represents the pulse beetle affecting stored legumes. Rhizopertha dominica is the lesser grain borer infesting whole cereal seeds. Trogoderma granarium is the Khapra beetle, a major grain germ pest in commercial stored grain warehouses.

54. (B) 10-12%
For safe long-term storage of cereal grains like wheat and paddy, moisture content must be reduced to ten to twelve percent through proper sun drying. Grain moisture exceeding twelve percent promotes insect pest proliferation, fungal mold development, heating, respiration losses, and rapid loss of seed viability during warehouse grain storage.

55. (B) I, II and IV
Pest surveys determine pest distribution and severity, while light and pheromone traps monitor populations. Microclimatic factors like temperature and relative humidity drive disease epidemics like late blight, enabling accurate disease forecasting. Short-range pest forecasting relies heavily on current microclimatic inputs and field trap catches rather than historical weather data alone.

56. (A) General Equilibrium Position (GEP) → Economic Threshold Level (ETL) → Economic Injury Level (EIL)
In pest population dynamics, General Equilibrium Position represents the average pest population density over time in an environment. Economic Threshold Level lies above GEP and marks the density requiring control intervention. Economic Injury Level is the highest density where pest damage causes economic loss equal to the financial cost of control measures.

57. (D) Aluminium phosphide
Aluminium phosphide is the most widely utilized solid fumigant tablet for controlling insect pests in enclosed grain warehouses, godowns, and storage silos. When exposed to atmospheric moisture, aluminium phosphide releases phosphine gas, a highly toxic respiratory poison that penetrates grain masses and eradicates all insect life stages safely inside stored commodities.

58. (A) Red rust flour beetle (Tribolium castaneum)
Red rust flour beetle, Tribolium castaneum, is a secondary storage pest unable to bore into intact, undamaged whole grain seeds. It feeds exclusively on previously damaged grains, grain dust, or milled flour products. In contrast, rice weevil, Khapra beetle, and lesser grain borer are primary storage pests capable of attacking whole sound grains.

59. (B) Covering moist soil with transparent polyethylene sheets during peak summer.
Soil solarization is an eco-friendly hydrothermal soil disinfestation method that involves covering moist, tilled soil with transparent polyethylene sheets during peak summer months. Solar energy trapped under plastic sheets elevates soil temperatures significantly, effectively killing

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soil-borne fungal pathogens, plant parasitic nematodes, weed seeds, and soil-dwelling insect pests in nursery beds.

60. (B) A nematode
Ear cockle disease of wheat is caused by the seed-borne plant parasitic nematode Anguina tritici. The nematode juveniles invade growing wheat seedlings, penetrate developing floral primordia, and transform normal healthy grains into dark, hard, wrinkled seed galls containing thousands of dormant nematodes, reducing crop seed quality and crop market yield.

61. (A) Profuse formation of galls or nodules on root systems
Root-knot nematodes, Meloidogyne species, inject secretional proteins into plant root cells, causing cellular giant cell formation, hyperplastic division, and hypertrophy. This results in characteristic galling and root knot swellings on roots, impeding water and nutrient uptake, leading to yellowing, severe stunting, wilting, and reduced crop yields in susceptible vegetable crops.

62. (C) Bemisia tabaci (Whitefly)
Bemisia tabaci, commonly known as whitefly, serves as the obligate insect vector for transmitting Yellow Vein Mosaic Virus in okra. Feeding whiteflies pick up the virus from infected hosts and transmit it to healthy plants during sap feeding, making vector control using yellow sticky traps and insecticides crucial for disease suppression.

63. (D) I and II only
Plant quarantine measures aim to prevent exotic pest introduction under the Destructive Insects and Pests Act of 1914. Quarantine operations apply to both international imports and domestic plant transport between states, known as domestic plant quarantine, which prevents regional spread of restricted pests like potato wart and bunchy top virus inside India.

64. (C) Faridabad
The Directorate of Plant Protection, Quarantine and Storage is an attached office of the Ministry of Agriculture and Farmers Welfare, Government of India. Headquartered at Faridabad, Haryana, it enforces plant quarantine regulations, oversees pesticide registration standards, coordinates locust control operations, and implements national integrated pest management policies across Indian states.

65. (B) Drones can operate effectively regardless of extremely high wind speeds and heavy rainfall.
Agricultural drones cannot operate effectively during high winds or heavy rainfall due to drift risks and stability issues. Drones utilize ultra-low volume technology, improving canopy coverage while reducing water requirements and operator chemical exposure. Environmental conditions like strong winds disrupt spray accuracy and safety during aerial application, restricting operations to calm weather.

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66. (D) A 'W' or 'X' shaped zigzag pattern
To conduct representative pest scouting and field surveillance, field workers walk through crops following a zigzag pattern shaped like a W or X. This sampling strategy ensures even coverage of central and peripheral field zones, preventing sampling bias caused by edge effects and delivering accurate estimations of overall pest populations.

67. (A) Low temperature (12-15°C) with high relative humidity (>90%)
Late blight of potato, caused by Phytophthora infestans, requires cool temperatures between twelve and fifteen degrees Celsius combined with high relative humidity exceeding ninety percent or continuous leaf wetness. These environmental conditions stimulate rapid sporangia germination and zoospores production, leading to explosive disease epidemics and swift canopy destruction in fields.

68. (C) Whitefly - Mungbean yellow mosaic virus
Mungbean yellow mosaic virus is transmitted by the whitefly vector, Bemisia tabaci. The whitefly feeds on infected plant sap and transmits yellow mosaic geminivirus to healthy pulse crops, causing brilliant yellow patches on leaves, severe plant stunting, and significant yield losses in crops like mungbean, urdbean, and soybean crop fields.

69. (A) Phytoplasma
Sugarcane grassy shoot is caused by a phytoplasma, a cell-wall-less prokaryotic microorganism inhabiting plant phloem tissues. Infected plants exhibit excessive tillering with narrow, pale green to chlorotic grassy leaves, giving shoots a bush-like appearance. The disease

suppresses stalk formation, causing severe yield reduction in both plant and ratoon sugarcane crops.

70. (D) Leafhoppers / Aphids
Natural field transmission of sugarcane grassy shoot phytoplasma occurs primarily through sap-sucking insect vectors, specifically leafhoppers and aphids like Melanaphis sacchari. These vector insects acquire phytoplasma while feeding on phloem sap of diseased sugarcane plants and transmit it to healthy crops, facilitating field spread alongside propagation through infected seed setts.

71. (B) Moist Hot Air Treatment (MHAT) of setts at 54°C for 2-2.5 hours
Moist Hot Air Treatment of sugarcane seed setts at fifty-four degrees Celsius for two to two and a half hours is a proven physical therapy method. Thermal treatment inactivates internal vascular pathogens like Leifsonia xyli causing ratoon stunting disease and grassy shoot phytoplasma without harming bud viability, producing disease-free nursery planting materials.

72. (C) A fastidious bacterium (Leifsonia xyli)
Ratoon stunting disease in sugarcane is caused by Leifsonia xyli subsp. xyli, a small, fastidious coryneform bacterium inhabiting xylem vessels. The pathogen restricts water and nutrient movement, causing thin canes, shortened internodes, overall crop stunting, and internal reddish-orange discolored vascular bundles visible at stem nodes when stalks are sliced open.

73. (D) Fusarium moniliforme
Pokkah Boeng disease of sugarcane is caused by the fungal pathogen Fusarium moniliforme. Visual symptoms include chlorosis at leaf bases, leaf distortion, wrinkling, shortening, and twisting of central foliage. Advanced stages develop top rot and characteristic knife-cut symptoms on stalks, resulting in severe growth retardation and yield loss in fields.

74. (A) Heavy nitrogen fertilization right after planting completely prevents borer attack.
Excessive nitrogen fertilization creates succulent vegetative growth that actually increases crop susceptibility to early shoot borer attacks rather than preventing them. Cultural practices like spreading trash mulch between rows, maintaining frequent light summer irrigations, and intercropping with spice crops effectively reduce microclimatic conditions favored by borers, suppressing pest population establishment.

75. (B) Honeydew secretion on leaves causing sooty mold and lower photosynthesis
Sugarcane pyrilla nymphs and adults suck sap from leaf undersides, excreting abundant clear honeydew on foliage. Saprophytic dark fungi, Capnodium species, colonize honeydew deposits, forming dense black sooty mold layers. This sooty coating blocks sunlight absorption, severely impairing photosynthetic activity, leaf functioning, sucrose synthesis, and juice quality in crop fields.

76. (B) Rats, jackals, and stalk borer
Propping sugarcane stalks by tying adjacent standing canes prevents crop lodging during late monsoon winds. Upright crops reduce favorable shelter and entry points for rodent pests like field rats and jackals, preventing stalk gnawing. Additionally, upright structural alignment hinders flight movement and egg deposition of adult stalk borer pest moths.

77. (A) Top borer
Top borer larvae specifically target and bore into upper growing shoots and terminal leaf whorls of standing sugarcane plants. In contrast, termites, white grubs, and root borers primarily attack underground setts, root systems, and subterranean basal cane tissues, making top borer distinct regarding damaged plant tissue spatial feeding location on hosts.

78. (C) Flat fan nozzle for herbicides, hollow cone nozzle for insecticides/fungicides
Spraying herbicides requires flat fan nozzles that deliver uniform, low-pressure rectangular spray patterns to coat soil or weed surfaces evenly without drift. In contrast, hollow cone nozzles produce fine mist droplets under higher pressure, delivering thorough coverage and canopy penetration on leaves and stems required for contact and systemic insecticides and fungicides.

79. (D) Trichogramma japonicum
Biological control of sugarcane top borer, Scirpophaga excerptalis, is achieved through field releases of Trichogramma japonicum, an effective egg parasitoid. Female wasps search for top borer egg masses on sugarcane leaves, parasitizing them by laying eggs inside, effectively destroying

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borer embryos before destructive larvae hatch to invade central plant shoots.

80. (C) During the monsoon and post-monsoon period from July to October
Sugarcane stalk borer, Chilo auricilius, experiences peak activity and rapid population buildup during monsoon and post-monsoon months from July to October. High atmospheric humidity combined with moderate temperatures favors larval development and stem boring, leading to extensive internodal tunneling, stalk breakage, reduced cane weight, and lowered juice sucrose sugar content.

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CHAPTER 08
Produce Storage and Quality Management

1. Which of the following is a traditional indoor storage structure commonly used in rural areas of Uttar Pradesh for storing grains?
(A) Metal Silo
(B) Kothi
(C) CAP storage
(D) Scientific warehouse

2. What is the maximum safe moisture content generally recommended for the long-term safe storage of wheat and paddy seeds?
(A) 6 to 8 percent
(B) 10 to 12 percent
(C) 14 to 16 percent
(D) 18 to 20 percent

3. What is the primary cause of sugar loss during the post-harvest storage (staling) of sugarcane before crushing?
(A) Inversion of sucrose into glucose and fructose
(B) Synthesis of excess starch in the internodes
(C) Conversion of reducing sugars into sucrose
(D) Hardening of the cane rind

4. Which of the following pests is known as the Rice Weevil and is a primary pest of stored cereals?
(A) Tribolium castaneum
(B) Callosobruchus chinensis
(C) Sitophilus oryzae
(D) Trogoderma granarium

5. In which year was the Uttar Pradesh State Warehousing Corporation (UPSWC) established to provide scientific storage facilities in the state?
(A) 1952
(B) 1958
(C) 1965
(D) 1972

6. Which chemical fumigant is most widely used in scientific warehouses for the control of stored grain pests?
(A) Zinc sulphate
(B) Copper oxychloride
(C) Sodium hypochlorite
(D) Aluminium phosphide

7. The problem of mycotoxin contamination, specifically Aflatoxin, in stored groundnut and maize is primarily caused by which fungus?
(A) Alternaria solani
(B) Aspergillus flavus
(C) Fusarium oxysporum
(D) Rhizoctonia solani

8. In standard scientific warehouse design, what is the recommended plinth height above ground level to prevent moisture ingress and rodent entry?
(A) 10 to 20 cm
(B) 30 to 45 cm
(C) 80 to 100 cm
(D) 150 to 175 cm

9. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): Spraying water on harvested sugarcane kept in the mill yard increases overall sucrose synthesis.
Reason (R): Moisture application reduces excessive drying and minimizes the weight loss of the cane stalks.
(A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
(B) Both Assertion (A) and Reason (R) are true but R is not the correct explanation of A.
(C) Assertion (A) is true but Reason (R) is false.
(D) Assertion (A) is false but Reason (R) is true.

10. For long-term preservation and minimizing sprouting, potatoes are generally kept in cold storage at a temperature of:
(A) -4 to -2 degrees Celsius
(B) 2 to 4 degrees Celsius
(C) 10 to 12 degrees Celsius
(D) 15 to 20 degrees Celsius

11. What is the main objective of the Gramin Bhandaran Yojana (Rural Godown Scheme)?
(A) To supply free seeds and fertilizers to rural farming communities
(B) To construct scientific storage capacity in

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rural areas
(C) To transport harvested sugarcane directly to sugar processing mills
(D) To establish new cooperative sugar processing mills in rural belts

12. Consider the following statements regarding post-harvest losses in sugarcane:
I. Delay in crushing harvested sugarcane increases the reducing sugar content.
II. Infection by Leuconostoc bacteria causes the formation of dextran in stored cane.
III. Leaving harvested cane in the field for a week enhances commercial cane sugar (CCS) percentage.
Which of the above statements is/are correct?
(A) Only I and II are correct
(B) Only II and III are correct
(C) Only I and III are correct
(D) All I, II, and III are correct

13. Which widely available botanical product is traditionally mixed with grains in Indian rural households to deter storage pests?
(A) Neem leaves
(B) Tulsi leaves
(C) Mango leaves
(D) Banyan leaves

14. At the national level, the Central Warehousing Corporation (CWC) functions under the administrative control of which ministry?
(A) Ministry of Agriculture and Farmers Welfare
(B) Ministry of Commerce and Industry
(C) Ministry of Consumer Affairs, Food and Public Distribution
(D) Ministry of Rural Development

15. The grading and standardisation of agricultural commodities in India for safe storage and marketing is certified under which mark?
(A) ISI Mark
(B) Hallmark
(C) FPO Mark
(D) AGMARK

16. Universal moisture meters used in procurement centers to check grain moisture before storage primarily work on the principle of:
(A) Thermal expansion and differential heat conduction
(B) High-resolution infrared absorption spectroscopy
(C) Electrical conductivity or capacitance
(D) High-frequency nuclear magnetic resonance

17. Match the storage pests in List I with their common names in List II:
List I: (Storage Pest)
P. Rhyzopertha dominica
Q. Sitotroga cerealella
R. Tribolium castaneum
S. Callosobruchus chinensis
List II: (Common Name)
1. Angoumois grain moth
2. Pulse beetle
3. Red rust flour beetle
4. Lesser grain borer
(A) P-4, Q-1, R-3, S-2
(B) P-1, Q-4, R-2, S-3
(C) P-4, Q-3, R-1, S-2
(D) P-3, Q-1, R-4, S-2

18. A negotiable warehouse receipt (NWR) allows farmers to manage storage risk and financial needs primarily by:
(A) Forcing the government to purchase their produce at a premium price
(B) Automatically insuring the standing crop against natural disasters
(C) Exchanging the receipt directly for key agricultural inputs like seeds
(D) Pledging the receipt to banks for short-term credit

19. What is a key advantage of modern metal silos over traditional bag storage in warehouses?
(A) They allow bulk handling and automated aeration
(B) They require intensive manual labor for loading and unloading individual bags
(C) They possess highly porous walls that permit free entry of ambient air
(D) They require significantly more ground surface area per tonne of grain

20. Select the correct logical sequence of operations for storing harvested grain in a scientific warehouse:
(A) Fumigation → Weighing → Drying → Cleaning → Stacking
(B) Cleaning → Drying → Weighing → Stacking → Fumigation
(C) Stacking → Fumigation → Cleaning → Drying → Weighing
(D) Drying → Fumigation → Weighing → Cleaning → Stacking

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21. Which type of chemical formulation is sometimes sprayed on harvested sugarcane to minimize bacterial growth and reduce sucrose inversion during transport and yard storage?
(A) Quaternary ammonium compounds
(B) Organophosphate insecticides such as chlorpyrifos
(C) Synthetic pyrethroids such as cypermethrin
(D) Copper-based fungicides such as Bordeaux mixture

22. To prevent fungal growth and rapid rancidity, oilseeds such as mustard and groundnut should be dried to a moisture content of:
(A) 3 to 4 percent
(B) 7 to 9 percent
(C) 12 to 14 percent
(D) 16 to 18 percent

23. Consider the following statements regarding produce storage principles:
I. Aeration helps in maintaining uniform temperature in bulk stored grains.
II. High relative humidity in the storehouse decreases the moisture content of dry grains.
III. Biological activity in grains generates heat, leading to 'heating' of the grain mass.
IV. Safe moisture levels vary depending on whether the produce is a cereal, pulse, or oilseed.
Which of the above statements is/are correct?
(A) I, II, and III
(B) I, III, and IV
(C) II, III, and IV
(D) I, II, and IV

24. For pre-storage sanitation, empty gunny bags and warehouse floors are commonly treated with which insecticide to eliminate hidden pests?
(A) Glyphosate
(B) 2,4-D
(C) Malathion
(D) Butachlor

25. Which quality parameter is critical for determining the maturity of sugarcane to ensure maximum sugar recovery before harvesting and storage?
(A) Leaf area index
(B) Soil moisture tension
(C) Number of tillers per clump
(D) Brix reading of the juice

26. Rodents cause significant damage in storage facilities. Which of the following correctly describes the nature of rodent damage?
(A) They cause qualitative and quantitative losses to produce and structures.
(B) They cause exclusively qualitative damage through contamination with urine, hair, and feces.
(C) They cause exclusively quantitative damage by directly consuming the stored grain mass.
(D) They selectively consume weed seeds present in bags, thereby cleaning the stored produce.

27. Chilling injury in perishable tropical produce (like bananas or mangoes) during cold storage typically occurs when:
(A) The storage temperature is strictly maintained above 15 degrees Celsius throughout storage.
(B) The temperature drops below the optimum requirement without freezing.
(C) The relative humidity inside the cold storage facility drops well below critical thresholds.
(D) The harvested produce is artificially treated with high concentrations of ethylene gas.

28. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): Modern metal silos are increasingly preferred over bag storage for the large-scale procurement of wheat.
Reason (R): Metal silos require significantly more land area per metric tonne of storage compared to conventional bag storage godowns.
(A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
(B) Both Assertion (A) and Reason (R) are true but R is not the correct explanation of A.
(C) Assertion (A) is true but Reason (R) is false.
(D) Assertion (A) is false but Reason (R) is true.

29. The formation of highly viscous, gummy substances in staled sugarcane juice, which hampers sugar crystallization in mills, is due to:
(A) Dextran formation by Leuconostoc mesenteroides
(B) Rapid transformation of sucrose and glucose into starch
(C) Excessive precipitation of insoluble calcium carbonate
(D) Rapid fermentation of juice into acetic acid by wild yeast

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30. In agricultural produce storage, the moisture content is standardized and usually expressed on a:
(A) Dry weight basis
(B) Volume basis
(C) Wet weight basis
(D) Specific gravity basis

31. Consider the following statements about the Central Warehousing Corporation (CWC):
I. It is a statutory body established under the Warehousing Corporations Act, 1962.
II. It offers pest control services not only inside its warehouses but also to external clients.
III. It is restricted by law to store only food grains and cannot store industrial goods.
Which of the above statements is/are correct?
(A) Only I and II are correct
(B) Only II and III are correct
(C) Only I and III are correct
(D) All I, II, and III are correct

32. Which of the following is classified as an 'internal feeder' among storage insect pests?
(A) Red rust flour beetle
(B) Saw-toothed grain beetle
(C) Pulse beetle
(D) Indian meal moth

33. In warehouse management, what is the primary purpose of providing 'dunnage'?
(A) To facilitate effective fumigation across all upper layers of grain stacks
(B) To prevent floor moisture transmission to bottom bags
(C) To seal cracks in the roof structure against direct rainwater leakage
(D) To measure and verify the weight of grain bags during final dispatch

34. Why is long-term cold storage of harvested sugarcane before crushing generally not practiced by sugar mills?
(A) Cold storage temperatures instantly freeze and burst cane cell walls, destroying all sucrose content.
(B) Harvested sugarcane strictly requires ambient temperatures above 40 degrees Celsius for post-harvest ripening.
(C) Low cold storage temperatures immediately trigger chemical conversion of all sucrose into insoluble starch.
(D) High bulk volume makes commercial cold storage economically unviable.

35. The 'Test Weight' of a grain lot, which serves as an indicator of grain plumpness and physical quality before storage, is defined as the weight of:
(A) 100 grains
(B) 500 grains
(C) 1000 grains
(D) 10,000 grains

36. Match the storage term/structure in List I with its description in List II:
List I: (Storage Term/Structure)
P. Kothi
Q. CAP Storage
R. Silo
S. Dunnage
List II: (Description)
1. Cover and Plinth temporary storage
2. Wooden crates or polythene laid on floor
3. Tall metal or concrete bulk storage tank
4. Traditional indoor mud storage structure
(A) P-4, Q-1, R-3, S-2
(B) P-1, Q-4, R-2, S-3
(C) P-4, Q-2, R-1, S-3
(D) P-3, Q-1, R-4, S-2

37. Consumption of food grains contaminated with mycotoxins like Aflatoxin over a long period poses the highest risk of disease to which human organ?
(A) Liver
(B) Lungs
(C) Heart
(D) Spleen

38. The mode of action of Aluminium Phosphide in pest control is the release of a highly toxic gas when the tablets come into contact with:
(A) Atmospheric nitrogen
(B) Carbon dioxide
(C) Direct sunlight
(D) Atmospheric moisture

39. In the context of sugarcane procurement and mill operations, what does the term 'Purchi' refer to?
(A) A government-subsidized chemical fertilizer allocation voucher given to cane farmers
(B) An indent slip authorizing a farmer to supply cane to a mill
(C) A legally binding labor contract for employing seasonal workers in cane harvesting
(D) An official quality document certifying the organic cultivation status of sugarcane

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40. In FCI and state procurement operations, the temporary storage method known as 'CAP storage' stands for:
(A) Controlled Atmospheric Preservation
(B) Capacity Allocation Process
(C) Cover and Plinth
(D) Centralized Agricultural Procurement

41. Arrange the following sequential events that lead to quality deterioration in harvested sugarcane left out in the field:
1. Increase in the level of reducing sugars (glucose and fructose)
2. Harvesting and detachment of the cane stalk from roots
3. Rapid moisture loss and weight reduction of the cane stalk
4. Enzymatic inversion of sucrose by the enzyme invertase

Select the correct code:
(A) 2, 4, 3, 1
(B) 2, 3, 4, 1
(C) 3, 2, 1, 4
(D) 4, 1, 2, 3

42. In modern silo management, forced aeration is primarily done to:
(A) Equalize grain temperature and prevent moisture migration
(B) Rapidly add extra moisture to dry grains before commercial processing
(C) Accelerate grain cooking speed for direct human consumption
(D) Intentionally increase the biological respiration rate of stored grains

43. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): Delayed crushing of harvested sugarcane leads to a significant decrease in sugar recovery at the mill.
Reason (R): Post-harvest staling promotes the inversion of sucrose into reducing sugars.
(A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
(B) Both Assertion (A) and Reason (R) are true but R is not the correct explanation of A.
(C) Assertion (A) is true but Reason (R) is false.
(D) Assertion (A) is false but Reason (R) is true.

44. The Negotiable Warehouse Receipt (NWR) system in India, which regulates the quality and safety of stored produce for pledge financing, operates under the regulatory oversight of:
(A) NABARD
(B) WDRA
(C) APEDA
(D) NAFED

45. In standard warehouses managed by warehousing corporations, the standard stacking height for 50 kg bags of wheat is generally restricted to:
(A) 5 to 7 layers
(B) 15 to 20 layers
(C) 30 to 35 layers
(D) 40 to 50 layers

46. The Khapra beetle (Trogoderma granarium), an important quarantine pest worldwide, causes severe damage primarily in the storage of:
(A) Sugarcane setts prepared for planting
(B) Fresh perishable leaf vegetables
(C) Cereal grains
(D) Fresh commercial cut flowers

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47. Which of the following is a physical/mechanical method of protecting stored grains from insect pests traditionally practiced by farmers?
(A) Applying chemical fumigants such as Aluminium Phosphide
(B) Treating seed grains with synthetic systemic fungicides
(C) Subjecting bulk grain lots to ionizing Cobalt-60 radiation
(D) Mixing grains with inert dusts

48. Consider the following statements regarding the fumigation process in scientific storage:
I. Fumigation is fully effective only when the storage structure is made completely airtight.
II. Aluminium phosphide releases phosphine gas upon contact with moisture.
III. After the required exposure period, the fumigated grain must immediately be consumed without aeration.

Which of the above statements is/are correct?
(A) Only I and II are correct
(B) Only II and III are correct
(C) Only I and III are correct
(D) All I, II, and III are correct

49. To facilitate proper inspection, aeration, and fumigation in a standard godown, the distance left as an alleyway between the grain stacks and the warehouse wall should be at least:

(A) 0.25 meter
(B) 0.75 to 1.0 meter
(C) 2.5 to 3.0 meters
(D) 5.0 meters

50. High levels of dextran in stored, staled sugarcane cause which specific problem during the manufacturing process?
(A) Excessive surface bleaching and discoloration of refined sugar crystals
(B) Complete operational failure and shutdown of factory boiler units
(C) Spontaneous chemical ignition and combustion of stored dry bagasse
(D) High juice viscosity and poor sugar crystallization

51. Which storage pest is notorious for reducing grain to mere hollow husks and producing a characteristic sweet, musty odor in the warehouse?
(A) Lesser grain borer (Rhyzopertha dominica)
(B) Angoumois grain moth (Sitotroga cerealella)
(C) Rice moth (Corcyra cephalonica)
(D) Khapra beetle (Trogoderma granarium)

52. Match the agricultural produce in List I with its generally recommended safe moisture content limit for storage in List II:
List I: (Agricultural Produce)
P. Paddy
Q. Wheat
R. Groundnut
S. Cabbage
List II: (Safe Moisture Limit / Storage Condition)
1. 10 to 12 percent
2. 7 to 8 percent
3. 13 to 14 percent
4. Highly perishable, needs cold storage
(A) P-3, Q-1, R-2, S-4
(B) P-1, Q-3, R-2, S-4
(C) P-3, Q-2, R-1, S-4
(D) P-2, Q-1, R-3, S-4

53. Where is the state headquarters of the Uttar Pradesh State Warehousing Corporation (UPSWC) located?
(A) Lucknow
(B) Kanpur
(C) Meerut
(D) Prayagraj

54. In sugarcane procurement, the State Advised Price (SAP) fixed for sugarcane is historically categorized based on which quality/grading parameter?
(A) The moisture percentage of the cane stalk
(B) The length of the sugarcane stalks
(C) The color of the cane rind
(D) Variety group (Early, General, Unsuitable)

55. Consider the following statements regarding the preservation of perishable produce in cold storage:
I. Low temperatures decrease the respiration rate of fruits and vegetables.
II. Freezing temperatures are universally safe and recommended for all fresh tropical fruits.
III. Cold storage extends the shelf life by delaying senescence.
IV. Relative humidity must be maintained at an optimum level to prevent shriveling.
Which of the above statements is/are correct?
(A) I, II, and III
(B) I, III, and IV
(C) II, III, and IV
(D) I, II, and IV

56. The fumigant EDB (Ethylene Dibromide), which was once widely used in grain storage, has been banned globally primarily due to its:
(A) Inability to control primary stored grain insect pests
(B) Highly volatile and explosive chemical properties
(C) Carcinogenic properties
(D) Prohibitively high manufacturing and transport costs

57. Which government agency manages the largest share of public warehousing capacity for food grains in India?
(A) National Cooperative Development Corporation (NCDC)
(B) Directorate of Marketing and Inspection (DMI)
(C) State Trading Corporation (STC)
(D) Food Corporation of India (FCI)

58. In standard scientific warehouse construction, rat-proof cones or physical rodent barriers are typically installed on the:
(A) Plinth pillars
(B) External roof ventilators
(C) Motorized exhaust fans
(D) Glass window panes

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59. To ensure minimal loss of sugar recovery, the time gap between sugarcane harvesting in the field and crushing at the mill should ideally not exceed:
(A) 24 to 48 hours
(B) 4 to 5 full days
(C) 7 to 10 full days
(D) 15 consecutive days

60. The phenomenon of 'heating' in improperly stored, damp food grains is primarily driven by the:
(A) Mechanical friction generated between individual grains during bulk loading
(B) Grain respiration and microflora
(C) Radiant thermal heat from direct sunlight penetrating thin roof sheets
(D) Spontaneous exothermic chemical reactions from residual pesticides

61. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): Storing food grains with a moisture content of 18-20% under normal warehouse conditions is highly unsafe.
Reason (R): High moisture content accelerates respiration, generates heat, and rapidly promotes fungal and insect pest attacks.
(A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
(B) Both Assertion (A) and Reason (R) are true but R is not the correct explanation of A.
(C) Assertion (A) is true but Reason (R) is false.
(D) Assertion (A) is false but Reason (R) is true.

62. Which of the following is an economic benefit of scientific grading and standardization of agricultural produce before storage?
(A) It completely and permanently eliminates the necessity of applying any pest control measures.
(B) It artificially reduces the physical weight of harvested produce, thereby lowering freight costs.
(C) It fetches premium market prices and enables warehouse receipts.
(D) It fundamentally alters the biological and botanical characteristics of the harvested crop.

63. In the context of sugarcane quality and sugar mill operations, the term 'CCS' stands for:
(A) Critical Cane Sucrose
(B) Combined Crop Storage
(C) Crystallized Cane Syrup
(D) Commercial Cane Sugar

64. Above what critical threshold of relative humidity do storage fungi (like Aspergillus and Penicillium) generally start multiplying rapidly on stored grains?
(A) 30 to 40 percent
(B) 45 to 55 percent
(C) 65 to 70 percent
(D) 95 to 100 percent

65. Select the correct sequence of operations for sugarcane processing from arrival at the mill yard to primary juice extraction:
(A) Unloading → Weighment → Juice extraction → Cane preparation (shredding)
(B) Weighment → Unloading → Cane preparation (shredding) → Juice extraction
(C) Cane preparation → Weighment → Unloading → Juice extraction
(D) Juice extraction → Unloading → Cane preparation → Weighment

66. Which of the following storage pests is classified as a 'secondary pest', meaning it typically attacks broken grains or milled products rather than whole, sound grains?
(A) Rice weevil (Sitophilus oryzae)
(B) Lesser grain borer (Rhyzopertha dominica)
(C) Pulse beetle (Callosobruchus chinensis)
(D) Red rust flour beetle

67. Consider the following statements about the Uttar Pradesh State Warehousing Corporation (UPSWC):
I. It was established with the objective of providing scientific storage for agricultural produce and notified commodities.
II. It operates purely as a private limited company with no state or central government equity.
III. It assists farmers by issuing negotiable warehouse receipts against their stored produce.
Which of the above statements is/are correct?
(A) Only I and II are correct
(B) Only I and III are correct
(C) Only II and III are correct
(D) All I, II, and III are correct

68. The "safe storage moisture limit" for agricultural produce is fundamentally determined by the

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equilibrium established between the grain moisture and the ambient:
(A) Atmospheric pressure
(B) Wind speed
(C) Relative humidity
(D) Solar radiation

69. Stale sugarcane negatively affects the efficiency of the sugar mill's boiling house primarily due to:
(A) Presence of reducing sugars and dextran
(B) A rapid decrease in the structural fiber content of the stalk
(C) Excessive absorption of external water diluting the raw juice
(D) The gradual biological conversion of soft pith into hard rind

70. In warehouse management, what is a 'Stack Plan'?
(A) A detailed financial forecasting chart predicting seasonal commodity market price trends
(B) An operational duty roster managing labor deployment for scheduled warehouse pest control
(C) A standardized chemical formula for calculating precise dosages when mixing fumigants
(D) A layout plan showing stack arrangements inside the godown

71. Match the storage issue in List I with its primary causal agent/factor in List II:
List I: (Storage Issue)
P. Dextran formation in cane juice
Q. Aflatoxin in groundnut
R. Complete hollowing of stored wheat grain
S. Loss of viability in stored seed
List II: (Causal Agent/Factor)
1. Aspergillus flavus
2. Lesser grain borer
3. High moisture and high temperature
4. Leuconostoc mesenteroides
(A) P-4, Q-1, R-2, S-3
(B) P-1, Q-4, R-3, S-2
(C) P-4, Q-2, R-1, S-3
(D) P-2, Q-1, R-4, S-3

72. In Controlled Atmosphere (CA) storage for highly perishable fruits, which environmental factors are strictly regulated along with temperature and humidity?
(A) Trace levels of ambient ethylene gas only
(B) Concentrations of atmospheric nitrogen and argon
(C) Oxygen and carbon dioxide levels
(D) Intensity of ambient ultraviolet radiation levels

73. What is the generally recommended dose of Aluminium Phosphide tablets (3g each) per metric tonne of grain for fumigating bagged storage under airtight covers?
(A) 0.5 tablet
(B) 2 to 3 tablets
(C) 10 to 15 tablets
(D) 25 to 30 tablets

74. Consider the following statements regarding storage risk management and produce insurance schemes:
I. It provides coverage against structural fire, lightning, and floods in the godown.
II. It guarantees the farmer against normal market price fluctuations.
III. It provides coverage against losses due to theft and burglary at the warehouse.
IV. It compensates for the loss of quality due to natural ripening over time.
Which of the above statements is/are correct?
(A) I and II
(B) I and III
(C) II and IV
(D) III and IV

75. To minimize storage losses, traditional structures like mud bins (Kothis) were historically coated on the inside with cow dung and mud primarily to:
(A) Provide essential mineral nutrients directly to the stored seed grains
(B) Seal cracks and crevices to prevent insect breeding
(C) Artificially increase internal temperature to slowly roast the grains
(D) Render the bottom structure completely waterproof against heavy flooding

76. To minimize quality loss before harvesting and subsequent storage, sugarcane maturity in the field is tested using a hand refractometer. A crop is considered mature and ready for harvest when the top-to-bottom Brix ratio is approximately:
(A) 0.25 to 0.40
(B) 0.50 to 0.60
(C) 0.90 to 1.00
(D) 1.50 to 2.00

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77. Whitewashing (applying a lime solution) on the internal walls of a conventional godown before stacking fresh produce serves to:
(A) Improve illumination and sanitize wall cracks
(B) Significantly increase the ambient relative humidity level inside the main godown
(C) Dramatically lower the ambient storehouse temperature by 10 degrees Celsius
(D) Form a completely non-porous and airtight structural seal on the roof

78. Which insect pest causes damage by spinning a silken web that binds the superficial layers of stored grains, especially maize and wheat?
(A) Rice weevil (Sitophilus oryzae)
(B) Lesser grain borer (Rhyzopertha dominica)
(C) Angoumois grain moth
(D) Pulse beetle (Callosobruchus chinensis)

79. The basic warehouse management rule known as "FIFO" ensures that produce quality is maintained by dispatching stock systematically. FIFO stands for:
(A) First Inspected, First Opened
(B) Fumigate Inside, Fumigate Outside
(C) Fast In, Fast Out
(D) First In, First Out

80. The process of completely replacing the fumigant-laden air inside a warehouse or silo with fresh outside air before workers can safely enter or grain can be dispatched is termed:
(A) Hermetic atmospheric sealing
(B) Chemical desiccation
(C) Aeration
(D) Thermal condensation

ANSWERS

1. (B) Kothi
Kothi is an earthen or mud storage structure traditionally utilized across rural Uttar Pradesh and other regions of northern India. Built using locally available clay, straw, and cow dung, these indoor bins preserve stored cereal grains by insulating them against ambient moisture absorption, extreme temperature variations, and destructive stored grain insect infestations over extended periods.

2. (B) 10 to 12 percent
Maintaining moisture levels between 10 to 12 percent is essential for the long-term safe storage of wheat and paddy seeds. Higher moisture content promotes rapid microbial growth, seed respiration, thermal heating, and pest activity, which severely degrades seed viability and germination capacity. Conversely, controlled low moisture preserves metabolic dormancy and prolongs storage life safely.

3. (A) Inversion of sucrose into glucose and fructose
Post-harvest sugar loss during the staling of sugarcane is primarily driven by the enzymatic inversion of sucrose into glucose and fructose. After harvest, active invertase enzymes break down non-reducing sucrose into reducing sugars. This biochemical breakdown reduces overall commercial sucrose recovery, decreases crystallization efficiency, and increases processing losses in sugar processing factories.

4. (C) Sitophilus oryzae
Sitophilus oryzae, commonly identified as the rice weevil, is a primary insect pest that attacks stored grain crops including rice, wheat, and maize. Female weevils bore into whole intact grains to lay eggs, and the developing larvae feed internally on the endosperm, causing extensive weight loss, grain hollowing, and secondary fungal contamination.

5. (B) 1958
The Uttar Pradesh State Warehousing Corporation was established in the year 1958 under the provisions of the Agricultural Produce (Development and Warehousing) Corporations Act. The corporation was created to develop scientific storage infrastructure, prevent post-harvest grain losses, assist farmers with safe storage facilities, and facilitate pledge financing against stored agricultural produce across the state.

6. (D) Aluminium phosphide
Aluminium phosphide is the most extensively utilized chemical fumigant in scientific warehouses for controlling stored grain insect pests. Upon exposure to ambient atmospheric moisture, it releases phosphine gas, which penetrates deeply into grain stacks and bulk structures. This gas effectively eliminates all life stages of pests, including eggs, larvae, pupae, and adult insects.

7. (B) Aspergillus flavus
Aspergillus flavus is the primary fungus responsible for producing hazardous mycotoxins, specifically aflatoxins, in stored agricultural commodities such as groundnut and maize. Fungal infection flourishes under warm temperature and high moisture conditions during post-harvest handling. Aflatoxin contamination causes severe chemical toxicity, quality deterioration, and significant health risks to human and animal consumers.

8. (C) 80 to 100 cm
A standard plinth height of 80 to 100 cm above ground level is specifically recommended in warehouse construction. This elevated structure acts as a physical barrier against capillary ground moisture absorption and prevents rodent movement into the storage hall. Additionally, it facilitates seamless loading and unloading operations aligned with standard transport vehicles.

9. (D) Assertion (A) is false but Reason (R) is true.
Spraying water on harvested sugarcane kept in mill yards does not synthesize sucrose, as synthesis occurs only in living plants through photosynthesis. However, water application reduces desiccation and minimizes physical weight loss caused by evaporation. Therefore, the statement regarding sucrose synthesis is false, whereas the explanation concerning weight loss reduction is factually correct.

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10. (B) 2 to 4 degrees Celsius
Maintaining cold storage temperatures between 2 to 4 degrees Celsius with controlled high relative humidity is ideal for long-term preservation of potatoes. This temperature range significantly suppresses tuber sprouting, reduces physiological respiration rates, and minimizes metabolic weight loss without inducing chilling injury or excessive accumulation of unwanted reducing sugars in the tubers.

11. (B) To construct scientific storage capacity in rural areas
The primary objective of the Gramin Bhandaran Yojana, also known as the Rural Godown Scheme, is to create scientific storage capacity with allied facilities in rural areas. This government initiative helps farmers prevent post-harvest distress sales, avoid produce deterioration, improve holding capacity, and obtain pledge credit against warehouse receipts to meet immediate financial requirements.

12. (A) Only I and II are correct
Delaying the crushing of harvested sugarcane enhances invertase activity, leading to an increase in reducing sugar content. Bacterial contamination by Leuconostoc species synthesizes viscous dextran, which severely hampers sugar recovery during factory processing. Conversely, leaving harvested cane exposed in the field reduces commercial cane sugar percentages through desiccation and sucrose degradation.

13. (A) Neem leaves
Dried neem leaves are widely recognized and traditionally utilized across Indian rural households for protecting stored food grains against insect pests. Neem contains potent bioactive limonoids, such as azadirachtin, which exert strong antifeedant, repellent, and growth-inhibiting properties against stored grain insects, offering an eco-friendly and effective natural grain preservation method for rural storage.

14. (C) Ministry of Consumer Affairs, Food and Public Distribution
The Central Warehousing Corporation functions under the administrative control of the Ministry of Consumer Affairs, Food and Public Distribution. Established as a statutory central public sector enterprise, it operates a vast network of warehouses across India, offering storage logistics, scientific preservation, and handling services for agricultural produce, seeds, fertilizers, and notified commodities.

15. (D) AGMARK
AGMARK is the official quality certification mark employed in India for grading and standardizing agricultural commodities. Regulated under the Agricultural Produce (Grading and Marking) Act of 1937, AGMARK ensures quality compliance, purity standards, and physical parameters, thereby facilitating transparent trading, post-harvest marketing, and scientific storage management of agricultural products across national markets.

16. (C) Electrical conductivity or capacitance
Universal moisture meters utilized at agricultural procurement centers operate on the principles of electrical conductivity or capacitance. The internal moisture content of grain directly influences its electrical resistance and dielectric constant. By measuring changes in current flow or electrical charge between electrodes, these electronic meters rapidly determine the precise moisture percentage before grain intake.

17. (A) P-4, Q-1, R-3, S-2
Storage insect pests are classified by distinct scientific names and common nomenclature. Rhyzopertha dominica is commonly known as the lesser grain borer. Sitotroga cerealella corresponds to the Angoumois grain moth. Tribolium castaneum is identified as the red rust flour beetle, and Callosobruchus chinensis is recognized as the pulse beetle damaging stored legumes.

18. (D) Pledging the receipt to banks for short-term credit
A Negotiable Warehouse Receipt serves as a legal instrument issued by registered warehouses certifying the deposit of specified agricultural produce. Farmers can pledge this receipt with banking institutions as financial collateral to secure short-term credit. This mechanism enhances liquidity, prevents immediate post-harvest distress sales, and allows producers to wait for favorable market prices.

19. (A) They allow bulk handling and automated aeration
Modern metal silos provide superior engineering advantages over traditional bag storage godowns. They enable large-scale mechanized

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bulk handling, automated loading, and continuous forced-air aeration systems. These automated features effectively regulate internal grain temperature, maintain uniform moisture distribution, eliminate labor-intensive manual bag stacking, and protect stored grains against weather elements and rodent destruction.

20. (B) Cleaning → Drying → Weighing → Stacking → Fumigation
Scientific warehouse management follows a strict sequence of post-harvest operations. Harvested grain is first cleaned to remove inert matter and foreign debris, then dried to achieve safe moisture limits. Next, precise weighing is conducted before stacking bags systematically on dunnage. Finally, fumigation is performed in sealed environments to eradicate insect pests completely.

21. (A) Quaternary ammonium compounds
Quaternary ammonium compounds are effective sanitizing and antibacterial formulations sprayed on harvested sugarcane stalks, transport vehicles, and mill yards. These compounds suppress bacterial proliferation, particularly by Leuconostoc mesenteroides, thereby significantly reducing post-harvest sucrose inversion, gum formation, and sugar degradation during transit and temporary storage prior to crushing operations in sugar mills.

22. (B) 7 to 9 percent
Oilseeds like mustard and groundnut require a lower moisture threshold of 7 to 9 percent for safe storage compared to starchy food grains. Higher fat content reduces the proportion of dry matter capable of holding water. Storing oilseeds above 9 percent moisture triggers enzymatic lipolysis, hydrolytic rancidity, fungal invasion, and rapid heating.

23. (B) I, III, and IV
Forced aeration maintains uniform temperature and prevents moisture migration in bulk grains. Biological respiration in seeds and associated microorganisms generates heat, causing localized grain heating. Safe moisture limits vary across cereals, pulses, and oilseeds due to chemical composition differences. However, high atmospheric relative humidity increases grain moisture through hygroscopic absorption rather than decreasing it.

24. (C) Malathion
Malathion is an organophosphate insecticide commonly used for residual surface spraying in warehouses, storage floors, and gunny bags. Applying malathion spray sanitizes empty godowns, eliminates hidden populations of stored product insects, and creates a protective chemical barrier that prevents cross-contamination of freshly harvested grain arrivals during subsequent commercial storage operations.

25. (D) Brix reading of the juice
Brix reading measures the percentage of total soluble solids dissolved in sugarcane juice, serving as a reliable maturity indicator. A hand refractometer measures Brix across upper, middle, and lower internodes. When the Brix ratio between top and bottom stalks approaches unity, the cane achieves optimal sucrose accumulation and maximum sugar recovery potential before harvest.

26. (A) They cause qualitative and quantitative losses to produce and structures.
Rodents cause significant dual damage in storage facilities. Quantitative losses occur through direct consumption of stored grains, seed destruction, and structural damage to packaging bags and wooden godown fittings. Qualitative losses result from contamination with rodent urine, droppings, hairs, and pathogenic microorganisms, rendering food grains unfit for direct human consumption.

27. (B) The temperature drops below the optimum requirement without freezing.
Chilling injury is a physiological disorder affecting tropical and subtropical produce exposed to low storage temperatures above their freezing point. When stored below critical threshold temperatures, physiological cell damage occurs, resulting in surface pitting, skin discoloration, internal tissue browning, uneven ripening, failure to soften, loss of characteristic aroma, and increased susceptibility to post-harvest decay fungi.

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28. (C) Assertion (A) is true but Reason (R) is false.
Modern metal silos are increasingly preferred over conventional bag storage due to mechanized bulk handling, superior pest control, and lower operational losses. However, silos utilize vertical storage designs that require significantly less land surface area per metric tonne compared to

traditional flat warehouse godowns. Thus, the assertion is correct, but the given reason is false.

29. (A) Dextran formation by Leuconostoc mesenteroides
Post-harvest staling of sugarcane invites infection by Leuconostoc mesenteroides bacteria. These bacteria metabolize sucrose to form dextran, a high molecular weight complex polysaccharide. Dextran significantly increases juice viscosity, retards filtration rates, impairs evaporation efficiency, and inhibits sucrose crystallization in sugar mill vacuum pans, leading to substantial sugar losses and operational disruptions.

30. (C) Wet weight basis
In commercial agricultural grain storage and trade, moisture content is standardly calculated and expressed on a wet weight basis. This percentage reflects the ratio of the weight of water contained within the sample to the total initial weight of the moist grain sample, providing a uniform benchmark for quality assessment, drying, and storage pricing.

31. (A) Only I and II are correct
The Central Warehousing Corporation is a statutory corporate body established under the Warehousing Corporations Act of 1962. It provides scientific storage for agricultural produce and offers commercial pest control services to external clients. Furthermore, it stores a wide spectrum of industrial goods, chemicals, and notified commodities, rather than restricting operations strictly to food grains.

32. (C) Pulse beetle
The pulse beetle (Callosobruchus chinensis) is classified as a primary internal feeder pest targeting pulse seeds. Female beetles cement eggs onto the seed coat, and hatched larvae bore directly inside the pulse grain. The larvae complete their development within the seed matrix, consuming internal contents before emerging as adults through characteristic exit holes.

33. (B) To prevent floor moisture transmission to bottom bags
Dunnage materials, such as wooden crates, bamboo mats, or heavy polythene sheets, are placed on warehouse floors before stacking grain bags. The primary function of dunnage is to create an insulating physical barrier between the concrete floor and bottom bag layers, preventing dampness absorption, capillary water movement, structural caking, and fungal spoilage.

34. (D) High bulk volume makes commercial cold storage economically unviable.
Harvested sugarcane is an extremely bulky, heavy, and low-value-per-unit-volume commodity. Constructing and operating cold storage facilities for huge volumes of harvested cane is economically impractical for sugar mills. Instead, sugar factories rely on efficient harvest scheduling, direct transportation logistics, and rapid crushing within 24 to 48 hours to minimize post-harvest sucrose losses.

35. (C) 1000 grains
Test weight, also known as thousand-kernel weight, is a standard quality parameter defined as the mass in grams of 1000 sound, clean individual seeds. This physical measurement serves as an indicator of grain density, endosperm fullness, and seed vigor. Higher test weights reflect superior grain filling, physical quality, and milling yield before storage.

36. (A) P-4, Q-1, R-3, S-2
Storage terms align with specific physical descriptions. Kothi refers to traditional indoor mud structures utilized for home grain storage. CAP storage denotes Cover and Plinth temporary outdoor storage. Silos are tall concrete or metal cylindrical tanks designed for bulk grain, and Dunnage refers to floor materials like wooden crates that isolate grain bags.

37. (A) Liver
Chronic consumption of food grains contaminated with mycotoxins, particularly aflatoxin produced by Aspergillus fungi, poses severe toxicological risks primarily targeting the human liver. Aflatoxins undergo hepatic bioactivation, causing hepatotoxicity, cellular damage, oxidative stress, cirrhosis, and a high risk of developing primary liver cancer (hepatocellular carcinoma) over prolonged dietary toxin exposure.

38. (D) Atmospheric moisture
Aluminium phosphide functions as a solid chemical fumigant formulation. Upon exposure to ambient atmospheric moisture or humidity present within storage godowns, it undergoes a chemical hydrolysis reaction. This reaction releases phosphine gas, a highly toxic, lethal

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fumigant that rapidly diffuses through grain masses to kill all stages of stored product insects.

39. (B) An indent slip authorizing a farmer to supply cane to a mill
In sugarcane procurement operations across Uttar Pradesh, the term Purchi refers to an official supply ticket or indent slip issued to sugarcane growers. It authorizes the farmer to harvest and supply a specified quantity of cane to designated sugar mill collection centers on scheduled dates, regulating cane arrival and preventing yard congestion.

40. (C) Cover and Plinth
CAP storage stands for Cover and Plinth storage, a temporary outdoor grain preservation technique extensively utilized by procurement agencies. Grains packed in gunny bags are stacked on elevated concrete plinths provided with bottom dunnage. The entire stack is covered with heavy plastic polythene covers and anchored securely to protect stored grains from ambient weather elements.

41. (B) 2, 3, 4, 1
The deterioration sequence of harvested sugarcane begins with stalk cutting and detachment from roots. Next, ambient exposure induces rapid desiccation and weight reduction. Subsequently, active invertase enzymes trigger the hydrolysis of sucrose. This enzymatic conversion ultimately results in increased concentration of reducing sugars, namely glucose and fructose, reducing commercial cane sucrose yield.

42. (A) Equalize grain temperature and prevent moisture migration
In modern bulk grain storage silos, forced aeration systems pass ambient air through the stored grain mass. The primary function of aeration is to equalize temperatures throughout the bulk, eliminate thermal gradients, dissipate localized hot spots, and suppress moisture migration. Consequently, aeration inhibits moisture accumulation near the surface, preventing fungal growth and spoilage.

43. (A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
Delayed crushing of harvested sugarcane causes severe post-harvest sucrose losses in sugar mills. Staling triggers physiological desiccation and activates internal invertase enzymes, transforming sucrose into reducing sugars like glucose and fructose. Reducing sugars do not crystallize during boiling operations. Thus, sucrose inversion directly causes reduced sugar recovery, validating both statements.

44. (B) WDRA
The Negotiable Warehouse Receipt system in India is regulated by the Warehousing Development and Regulatory Authority. Established under the Warehousing (Development and Regulation) Act of 2007, WDRA registers godowns, standardizes warehouse operations, ensures physical safety of stored agricultural produce, and promotes negotiable warehouse receipts to facilitate formal pledge financing for farmers.

45. (B) 15 to 20 layers
In scientific warehouses managed by public warehousing corporations, standard stacking height for 50 kg bags of wheat is restricted to 15 to 20 layers. Limiting stack height prevents excessive mechanical pressure on lower bags, avoids bag bursting, ensures structural stack stability, facilitates air circulation, and maintains required safety clearance from roof trusses.

46. (C) Cereal grains
The Khapra beetle (Trogoderma granarium) is a destructive stored grain insect pest classified worldwide as a strict quarantine object. Its voracious larvae attack stored cereal grains such as wheat, barley, maize, and sorghum. The pest causes heavy quantitative loss, produces frass, and survives extreme drought conditions, posing severe phytosanitary risks to international trade.

47. (D) Mixing grains with inert dusts
Mixing food grains with non-toxic inert dusts, such as diatomaceous earth, kaolin, or activated clay, is a traditional mechanical protection method against storage insect pests. Inert dust particles adhere to insect cuticles, absorbing protective epicuticular wax layers. This physical disruption causes lethal desiccation and death of insects without leaving toxic chemical residues on stored grains.

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48. (A) Only I and II are correct
Fumigation efficacy relies on maintaining gas-tight, airtight conditions within the storage structure to retain lethal chemical concentrations over time. Aluminium phosphide reacts with ambient air moisture to release toxic phosphine

gas. However, after completing fumigation, grain must undergo mandatory thorough aeration before dispatch to dissipate residual fumigant gases and ensure consumer safety.

49. (B) 0.75 to 1.0 meter
In standard scientific warehouse layouts, an alleyway margin of 0.75 to 1.0 meter is mandatorily maintained between grain bag stacks and warehouse walls. This peripheral space facilitates physical inspection, promotes air circulation, prevents moisture transfer from external walls, allows effective pest control spraying, and provides operational space for laying fumigation covers during warehouse gas treatments.

50. (D) High juice viscosity and poor sugar crystallization
High levels of dextran, produced by Leuconostoc bacterial contamination in staled sugarcane, severely disrupt sugar processing operations. Dextran significantly increases the viscosity of cane juice and syrups. Elevated viscosity reduces heat transfer in evaporators, slows down juice filtration, inhibits orderly sucrose crystal growth in vacuum pans, and increases final molasses sugar losses.

51. (A) Lesser grain borer (Rhyzopertha dominica)
The lesser grain borer (Rhyzopertha dominica) is a primary pest of stored cereals known for voracious feeding habits. Both adults and larvae bore into sound grains, devouring internal starch and leaving behind hollowed grain shells or husks. Severe infestations produce large amounts of floury frass and impart a characteristic sweet, musty odor in storage facilities.

52. (A) P-3, Q-1, R-2, S-4
Agricultural commodities require specific safe moisture limits or conditions during storage. Paddy requires 13 to 14 percent moisture for structural storage. Wheat is safely preserved at 10 to 12 percent moisture. Groundnut, being an oilseed, demands a lower threshold of 7 to 8 percent, while fresh cabbage is highly perishable and requires cold storage.

53. (A) Lucknow
The state headquarters of the Uttar Pradesh State Warehousing Corporation is located in Lucknow. As a statutory state corporation, UPSWC manages administrative policies, logistics planning, regional warehouse networks, and procurement infrastructure from its headquarters in Lucknow to provide scientific warehousing facilities and post-harvest storage solutions for agricultural produce across Uttar Pradesh.

54. (D) Variety group (Early, General, Unsuitable)
In Uttar Pradesh, the State Advised Price for sugarcane is determined and announced based on variety categorization. Sugarcane varieties are classified into Early, General, and Unsuitable categories according to their sucrose content, maturity duration, and sugar recovery potential. High-yielding early varieties with higher sucrose content command a price premium over general and unsuitable varieties.

55. (B) I, III, and IV
Cold storage preserves perishable produce by lowering physiological respiration rates, reducing ethylene production, and delaying senescence. Maintaining optimum high relative humidity prevents moisture loss and shriveling. However, sub-zero freezing temperatures are not universally safe for fresh tropical fruits, as freezing induces severe cell structure rupture, tissue breakdown, chilling injury, and total quality deterioration.

56. (C) Carcinogenic properties
Ethylene Dibromide was formerly used as a liquid chemical fumigant for stored grain pests and soil nematodes. Its regulatory authorization was revoked globally after toxicology studies confirmed its potent carcinogenic, mutagenic, and reproductive toxicity risks. EDB leaves persistent chemical residues in treated food grains, posing severe long-term cancer risks to human and animal health.

57. (D) Food Corporation of India (FCI)
The Food Corporation of India, established under the Food Corporations Act of 1964, manages the largest public warehousing and storage capacity for food grains in India. FCI oversees national buffer stocking, executes central procurement of wheat and paddy, maintains strategic food reserves, and distributes food grains across states under the Public Distribution System to ensure national food security.

58. (A) Plinth pillars
Rat-proof cones or metal rodent guards are structurally fitted onto the plinth pillars of

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scientific warehouses. These metal collars project downward at a downward angle along supporting support columns. They prevent rats and other rodents from scaling outer structural pillars, climbing into storage halls, and accessing stored grain bags, thereby minimizing physical contamination and loss.

59. (A) 24 to 48 hours
To maximize commercial sugar recovery, the time gap between sugarcane harvesting and crushing at the mill should ideally not exceed 24 to 48 hours. Delayed crushing accelerates moisture loss, promotes invertase activity, increases reducing sugars, and triggers Leuconostoc bacterial contamination, leading to dextran formation and significant operational losses during sugar manufacturing.

60. (B) Grain respiration and microflora
The phenomenon of heating in damp stored grains is driven by biological respiration from living seeds and associated storage microflora, including fungi and bacteria. High grain moisture accelerates metabolic respiration rates, breaking down carbohydrates and releasing metabolic heat, carbon dioxide, and moisture. This accumulated thermal energy causes rapid localized heating, grain spoilage, and quality degradation.

61. (A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
Storing food grains with high moisture levels of 18 to 20 percent under normal ambient conditions is hazardous. Elevated grain moisture significantly increases metabolic respiration, releasing heat and water vapor. This creates hot spots that promote rapid multiplication of storage fungi, mould growth, insect infestation, and grain heating. Thus, both statements are correct.

62. (C) It fetches premium market prices and enables warehouse receipts.
Scientific grading and standardization classify agricultural produce into uniform quality grades based on physical parameters like purity, moisture, and sound grain percentage. Standardized quality grading provides market transparency, enables premium price discovery, reduces transaction costs, facilitates electronic trading across platforms, and allows farmers to issue negotiable warehouse receipts for formal bank financing.

63. (D) Commercial Cane Sugar
Commercial Cane Sugar (CCS) is a standardized quality parameter expressed as a percentage, representing the actual yield of pure white sugar recoverable from sugarcane. Calculated using juice sucrose percent (Pol) and Brix readings while adjusting for fiber content, CCS serves as the primary benchmark for evaluating sugarcane quality and determining price payment to growers.

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64. (C) 65 to 70 percent
Storage fungi, including species of Aspergillus and Penicillium, require a critical relative humidity threshold of 65 to 70 percent to initiate germination and hyphal growth on stored grains. Below 65 percent relative humidity, fungal activity remains dormant. Above 70 percent, moisture absorption accelerates fungal proliferation, producing mycotoxins, grain discoloration, heating, and spoilage.

65. (B) Weighment → Unloading → Cane preparation (shredding) → Juice extraction
Upon arrival at sugar mills, cane trucks undergo initial gross weighment at weighbridges. After weighment, sugarcane is unloaded onto carrier aprons. The stalks then pass through cane preparation machinery, including knives and heavy shredders, which break stalks into small pieces to rupture storage cells. Finally, prepared cane passes through roller mills for primary juice extraction.

66. (D) Red rust flour beetle
The red rust flour beetle (Tribolium castaneum) is classified as a secondary storage insect pest. Unlike primary pests, adult beetles and larvae cannot penetrate sound, unbroken, intact whole grain kernels. They feed primarily on broken grains, damaged seeds, grain dust, flour, and milled cereal products, causing secondary contamination, foul odors, and quality deterioration.

67. (B) Only I and III are correct
The Uttar Pradesh State Warehousing Corporation was established as a statutory corporate body to provide scientific storage infrastructure for agricultural commodities and notified goods. It assists farmers by issuing

negotiable warehouse receipts to facilitate pledge financing. UPSWC is a public sector statutory enterprise jointly owned by the State Government and Central Warehousing Corporation, not a private company.

68. (C) Relative humidity
The safe storage moisture limit for agricultural produce is determined by the equilibrium moisture content concept. Stored seeds are hygroscopic materials that absorb or release moisture until reaching equilibrium with the ambient relative humidity of surrounding air. At approximately 65 to 70 percent relative humidity, grain moisture stabilizes at safe levels that inhibit mold growth and pest activity.

69. (A) Presence of reducing sugars and dextran
Stale sugarcane significantly impairs boiling house operations in sugar mills due to high levels of reducing sugars and bacterial dextran. Reducing sugars increase molasses formation and impede sucrose crystallization. Concurrently, dextran increases juice viscosity, causing severe heating surface fouling, retarding evaporation, slowing filtration rates, and reducing final recovery efficiency of commercial white sugar.

70. (D) A layout plan showing stack arrangements inside the godown
A stack plan is an operational layout blueprint utilized in scientific warehouse management. It specifies the exact physical arrangement, dimensions, alleyway clearances, stack numbering, and structural distribution of grain stacks within a godown floor. Proper stack planning maximizes storage capacity utilization, ensures structural floor load balance, and facilitates systematic inventory tracking, aeration, and pest control treatments.

71. (A) P-4, Q-1, R-2, S-3
Storage issues map to specific causal factors. Dextran formation in cane juice is caused by Leuconostoc mesenteroides bacteria. Aflatoxin contamination in groundnut is produced by Aspergillus flavus fungus. Complete hollowing of stored wheat grain results from feeding by the lesser grain borer, and loss of seed viability is driven by high moisture and high temperature.

72. (C) Oxygen and carbon dioxide levels
In Controlled Atmosphere storage systems for perishable horticultural produce, oxygen and carbon dioxide gas concentrations are precisely manipulated alongside low temperature and relative humidity. Typically, oxygen levels are reduced to around 1 to 3 percent while carbon dioxide levels are elevated. This modified gas composition depresses cellular respiration, delays ripening, and extends shelf life.

73. (B) 2 to 3 tablets
For effective fumigation of bagged grain stored under gas-tight plastic covers, the standard recommended dosage of Aluminium Phosphide is 2 to 3 tablets (3 grams each) per metric tonne of grain. This dosage generates sufficient phosphine gas concentration to eliminate all developmental stages of stored grain insect pests while ensuring post-ventilation safety compliance.

74. (B) I and III
Produce storage insurance schemes provide commercial financial risk protection against unforeseen physical disasters occurring inside godowns. Covered risks include accidental fire, lightning, flooding, storm damage, theft, and burglary. However, produce insurance policies do not cover normal market price fluctuations or natural biological quality degradation resulting from physiological ripening and prolonged aging during storage.

75. (B) Seal cracks and crevices to prevent insect breeding
Coating the interior of traditional mud bins (Kothis) with a mixture of cow dung and clay paste is an ancient post-harvest management practice. The slurry seals microscopic wall cracks, structural crevices, and rough surfaces where insect eggs and larvae hide. This smooth coating reduces pest harbourage, limits moisture absorption, and improves storage hygiene.

76. (C) 0.90 to 1.00
Sugarcane maturity is field-assessed using a hand refractometer to measure soluble solids (Brix) in juice from upper and lower internodes. During early growth, lower internodes show higher sucrose concentrations. As the crop reaches full commercial maturity, sucrose accumulates uniformly throughout the stalk. A top-to-bottom Brix ratio between 0.90 and 1.00 indicates peak sucrose content.

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77. (A) Improve illumination and sanitize wall cracks
Applying a whitewash (calcium hydroxide lime solution) on internal warehouse walls prior to stacking fresh grain serves multiple sanitary purposes. Lime possesses natural antimicrobial properties that disinfect internal wall surfaces, fill fine wall cracks, and seal pest hiding micro-sites. Additionally, the bright white coating significantly improves light reflection and internal illumination inside godown structures.

78. (C) Angoumois grain moth
The Angoumois grain moth (Sitotroga cerealella) is a major pest of stored food grains, particularly maize, wheat, and paddy. Developing larvae feed internally within seeds, while older larvae spin silken webbing before pupation. This silk web binds surface grain layers, creating webbed mats that contaminate stored grain stocks, foul grain handling equipment, and impede aeration.

79. (D) First In, First Out
FIFO stands for First In, First Out, a foundational inventory management protocol practiced in warehouse operations. Under this rule, older grain stock batches received earliest are dispatched first for processing or distribution. This systematic rotation prevents long-term storage stagnation, reduces exposure duration to pests, minimizes age-related quality loss, and optimizes overall storage space management.

80. (C) Aeration
Aeration refers to the process of thoroughly purging and exchanging fumigant gas-laden air inside warehouses, silos, or under covers with clean outside air following completion of fumigation treatments. Controlled aeration rapidly dissipates toxic gas residues, bringing chemical concentrations below health threshold limits to ensure safe entry for warehouse workers and permit safe handling of grain.

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and R is the correct explanation of A.
(B) Both Assertion (A) and Reason (R) are true but R is not the correct explanation of A.
(C) Assertion (A) is true but Reason (R) is false.
(D) Assertion (A) is false but Reason (R) is true.

60. For rapid, highly sensitive, and early detection of Sugarcane Red Rot and Grassy Shoot Disease in seed canes, which biotechnological tool is most accurate?
(A) Visual field scouting and symptom evaluation
(B) Refractometric measurement of cane Brix percentage
(C) ELISA and PCR molecular diagnostics
(D) Routine chemical testing of soil pH levels

61. Match the agricultural bio-agents in List I with their primary functions in List II.
List I: (Agricultural Bio-agent)
P. Trichoderma harzianum
Q. Azotobacter
R. Bacillus thuringiensis
S. Beauveria bassiana
List II: (Primary Function)
1. Entomopathogenic fungus targeting insect pests
2. Bio-fungicide against soil-borne diseases
3. Free-living nitrogen-fixing bacteria
4. Bacterial bio-pesticide against caterpillars
(A) P-3, Q-2, R-1, S-4
(B) P-2, Q-4, R-3, S-1
(C) P-1, Q-3, R-4, S-2
(D) P-2, Q-3, R-4, S-1

62. The mandatory requirement for establishing 'refuge' lines (planting non-Bt cotton around a Bt cotton field) is intended to:
(A) Improve overall lint quality and fiber length of Bt cotton plants
(B) Facilitate natural cross-pollination to generate field hybrid seeds
(C) Delay Bt toxin resistance in bollworm populations
(D) Provide natural nesting habitats for beneficial predatory birds

63. In biosafety terminology, what is a BSL (Biosafety Level) containment facility designed for?
(A) Storing harvested field crops under controlled humidity to prevent rodent damage
(B) Safely containing biological agents and GMOs to prevent environmental escape
(C) Assembling and testing heavy agricultural machinery under controlled safety standards
(D) Processing raw sugarcane into refined sugar under strict industrial hygienic conditions

64. The primary limitation or ethical concern frequently cited regarding the adoption of 'terminator technology' (Genetic Use Restriction Technology) in seeds is:
(A) It drastically reduces essential vitamins and nutritional value of harvested crops
(B) It forces crop plants to consume double the normal quantity of irrigation water
(C) It increases plant susceptibility to widespread local viral and fungal diseases
(D) It renders harvested seeds sterile, preventing seed saving and reuse

65. Microsatellites, which are widely used for DNA fingerprinting and variety identification, are technically known as:
(A) Simple Sequence Repeats (SSRs)
(B) Single Nucleotide Polymorphisms (SNPs)
(C) Restriction Fragment Length Polymorphisms (RFLPs)
(D) Quantitative Trait Loci (QTLs)

66. Consider the following statements about Somaclonal Variation:
I. It occurs among plants regenerated through in vitro tissue culture.
II. It is always a planned and highly predictable genetic change.
III. It can be used to select cell lines tolerant to salinity or disease toxins.
IV. It is completely useless for sugarcane variety improvement.
Which of the above statements is/are incorrect?
(A) I and III only
(B) II and IV only
(C) I, II and III
(D) II, III and IV

67. In plant tissue culture, the term 'Synthetic Seed' or 'Artificial Seed' refers to:
(A) Somatic embryos encapsulated in sodium alginate gel
(B) Precision plastic seed models manufactured to calibrate mechanical seed drills
(C) True botanical seeds genetically edited using targeted CRISPR-Cas9 technologies
(D) Commercial seeds generated by cross-pollinating two male-sterile parent lines

68. Choose the correct sequential order of general steps involved in the process of gene cloning:

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(D) Termites and wireworms

11. The resistance in Bt cotton is derived from specific 'cry' genes isolated from:
(A) Bacillus thuringiensis
(B) Beauveria bassiana
(C) Trichoderma viride
(D) Pseudomonas fluorescens

12. Consider the following statements regarding Genetically Modified (GM) crops:
I. GM crops are developed by introducing foreign DNA into the plant's genome.
II. Bt cotton is the only GM crop currently approved for commercial cultivation in India.
III. GM crops inherently require a higher dose of chemical fertilizers compared to traditional varieties.
Which of the above statements is/are correct?
(A) I and II only
(B) II and III only
(C) I and III only
(D) I, II and III

13. In gene cloning technology, restriction endonucleases function as:
(A) Vectors carrying foreign genetic material into host cells
(B) Molecular glue that joins separated DNA fragments together
(C) Enzymes synthesizing new DNA strands during replication
(D) Molecular scissors that cut DNA at specific sequences

14. Plasmids are extensively used in agricultural biotechnology as vectors. They are fundamentally:
(A) Linear genomic DNA found within eukaryotic plant nuclei
(B) Messenger RNA molecules involved in protein synthesis
(C) Extra-chromosomal, circular bacterial DNA molecules
(D) Protein caψds surrounding plant virus genetic material

15. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): Apical meristem culture is widely used to develop virus-free sugarcane seed cane.
Reason (R): The rate of cell division in the apical meristem is faster than the rate of viral multiplication, and it lacks well-developed vascular tissue.
(A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
(B) Both Assertion (A) and Reason (R) are true but R is not the correct explanation of A.
(C) Assertion (A) is true but Reason (R) is false.
(D) Assertion (A) is false but Reason (R) is true.

16. In molecular biology, RFLP is a prominent molecular marker technique. What does RFLP stand for?
(A) Rapid Fragment Length Polymerase
(B) Recombinant Factor Length Polymorphism
(C) Restricted Fluorescent Locus Primer
(D) Restriction Fragment Length Polymorphism

17. The application of Marker-Assisted Selection (MAS) in crop improvement helps breeders primarily to:
(A) Select target traits early in seedlings without waiting for plant maturity
(B) Transform non-leguminous crops to fix atmospheric nitrogen directly in soil
(C) Eliminate all requirements for synthetic chemical fertilizers in fields
(D) Induce targeted site-specific mutations manually within plant genomes

18. Which of the following best describes 'Transgenic' crops?
(A) Varieties developed exclusively through traditional cross-pollination techniques
(B) Mutants selected following exposure to natural or artificial plant radiation
(C) Crops expressing a foreign gene inserted from another species
(D) Clonal plants multiplied rapidly through in vitro tissue culture techniques

19. The bio-fertilizer widely used as a seed treatment to fix atmospheric nitrogen symbiotically in leguminous crops is:
(A) Rhizobium
(B) Azotobacter
(C) Azospirillum
(D) PSB (Phosphate Solubilizing Bacteria)

20. Consider the following statements about agricultural bio-agents:
I. Trichoderma viride is a beneficial fungus used to manage soil-borne plant diseases like red rot and wilt.
II. VAM (Vesicular Arbuscular Mycorrhiza)

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(D) Somaclonal variations

40. Somaclonal variation is considered highly advantageous for crop improvement because it:
(A) Provides genetic variability to select traits like disease resistance
(B) Guarantees complete genetic uniformity across all regenerated plant progenies
(C) Completely eliminates any requirement for subsequent field testing and evaluation
(D) Consistently generates homozygous doubled haploid plants in every culture cycle

41. The biotechnological approach of breeding crops with higher levels of vitamins, minerals, or proteins to improve nutritional quality is known as:
(A) Bioremediation
(B) Biofortification
(C) Biomagnification
(D) Biosensing

42. Arrange the following fundamental steps of Recombinant DNA Technology in the correct chronological order:
I. Insertion of recombinant DNA into a host cell
II. Isolation of the desired gene (DNA fragment)
III. Screening and selection of transformed cells
IV. Ligation of the DNA fragment into a suitable vector
(A) II, IV, I, III
(B) II, I, IV, III
(C) IV, II, I, III
(D) I, II, III, IV

43. 'Golden Rice' is one of the most famous examples of a biofortified genetically modified crop. It is enriched with:
(A) Provitamin A (Beta-carotene)
(B) Essential Vitamin C (Ascorbic acid)
(C) Essential minerals like Iron and Zinc
(D) Lysine and tryptophan rich proteins

44. In gene banks, long-term conservation of plant genetic resources is often done through cryopreservation. This involves storing biological material in liquid nitrogen at a temperature of:
(A) -20 °C
(B) -80 °C
(C) -196 °C
(D) -273 °C

45. Consider the following statements regarding Plant Gene Banks:
I. Gene banks conserve crop genetic diversity for future breeding programs.
II. The National Bureau of Plant Genetic Resources (NBPGR) manages India's national gene bank.
III. Recalcitrant seeds can be easily dried and stored at very low temperatures in standard seed vaults for decades.
IV. Cryopreservation is used to store shoot tips and somatic embryos of vegetatively propagated crops.
Which of the above statements is/are correct?
(A) I, II and III only
(B) I, II and IV only
(C) II, III and IV only
(D) I, III and IV only

46. During the tissue culture of sugarcane, high concentrations of auxins like NAA or IBA are added to the culture medium in the final stage to induce:
(A) Callus formation
(B) Shoot multiplication
(C) Root initiation
(D) Flowering

47. The critical process in micropropagation where in vitro generated plantlets are gradually adapted to the natural external environment is called:
(A) Vernalization (Cold treatment)
(B) Acclimatization (Hardening)
(C) Stratification (Moist chilling)
(D) Encapsulation (Bead coating)

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48. In India, the first genetically modified crop officially permitted for commercial agricultural cultivation was:
(A) Bt Brinjal
(B) GM Mustard (DMH-11)
(C) Golden Rice
(D) Bt Cotton

49. Match the national research institutes in List I with their headquarters in List II.
List I: (National Research Institute)
P. NBPGR
Q. SBI (Sugarcane Breeding Institute)
R. UPCSR
S. NSI (National Sugar Institute)
List II: (Headquarters)
1. Coimbatore
2. Shahjahanpur
3. New Delhi
4. Kanpur

30. Biosafety guidelines and regulations in agricultural biotechnology are primarily designed to:
(A) Maximize commercial profit margins and patent rights for private seed companies
(B) Subsidize the market distribution cost of chemical fertilizers for small farmers
(C) Prevent potential risks of GMOs to human health and the environment
(D) Ensure the complete eradication and replacement of indigenous crop varieties

31. Consider the following statements regarding regulatory frameworks in biotechnology:
I. The Cartagena Protocol is an international agreement governing the movements of living modified organisms (LMOs).
II. Field trials of any GM crop in India require prior approval from the RCGM and GEAC.
III. The Environment Protection Act, 1986 is the umbrella legislation for biosafety regulations in India.
Which of the above statements is/are correct?
(A) I and II only
(B) II and III only
(C) I and III only
(D) I, II and III

32. In the development of climate-resilient crop varieties, scientists frequently target the DREB gene family. This gene family provides tolerance primarily against:
(A) Infection by major viral and fungal pathogens
(B) Severe damage from soil nematode infestations
(C) Heavy metal toxicity and acidity in soil
(D) Drought, salinity, and cold stress

33. In the agricultural seed industry, DNA fingerprinting is increasingly replacing the traditional Grow Out Test (GOT) for testing:
(A) Genetic purity of the seed lot
(B) Seed germination percentage
(C) Seed moisture content
(D) Physical purity (weed seed content)

34. Which molecular technique relies on short, repeating sequences of DNA that are highly variable among individuals to generate a DNA fingerprint?
(A) Northern Blotting technique for RNA analysis
(B) Flow Cytometry for cellular DNA measurement
(C) SSR (Simple Sequence Repeats)
(D) Somatic embryogenesis tissue culture

35. The National Institute for Plant Biotechnology (NIPB), a premier ICAR institute dedicated to biotechnological research in crops, is located in:
(A) New Delhi
(B) Lucknow
(C) Hyderabad
(D) Coimbatore

36. Which institute is primarily responsible for research and breeding to develop superior sugarcane varieties suitable for subtropical conditions?
(A) IARI (Indian Agricultural Research Institute), New Delhi
(B) IIHR (Indian Institute of Horticultural Research), Bengaluru
(C) CRRI (Central Rice Research Institute), Cuttack
(D) UPCSR (UP Council of Sugarcane Research), Shahjahanpur

37. In crop improvement through hybridization, the manual removal of anthers from a bisexual flower before pollen shedding is termed:
(A) Bagging
(B) Emasculation
(C) Tagging
(D) Introgression

38. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): The cultivation of Bt cotton has significantly reduced the use of broad-spectrum chemical insecticides in cotton farming.
Reason (R): Bt cotton produces a specific endotoxin that naturally kills lepidopteran pests like the pink bollworm.
(A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
(B) Both Assertion (A) and Reason (R) are true but R is not the correct explanation of A.
(C) Assertion (A) is true but Reason (R) is false.
(D) Assertion (A) is false but Reason (R) is true.

39. Genetic variations that occur spontaneously in plant cells during in vitro tissue culture are technically known as:
(A) Gametoclonal variations
(B) Hybrid vigour
(C) Point mutations

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enhances phosphorus uptake by plant roots.
III. Azotobacter is primarily used for symbiotic nitrogen fixation in pulses.
IV. NPV (Nuclear Polyhedrosis Virus) is a bio-pesticide used against lepidopteran caterpillars.
Which of the above statements is/are correct?
(A) I, II and III only
(B) I, II and IV only
(C) II, III and IV only
(D) I, III and IV only

21. Which bio-pesticide is most commonly recommended for the management of Red Rot disease in sugarcane by treating the sett or soil?
(A) Bacillus thuringiensis
(B) Trichoderma harzianum / viride
(C) Metarhizium anisopliae
(D) Beauveria bassiana

22. In the context of modern biotechnology, what is the primary function of the CRISPR-Cas9 system?
(A) Large-scale vegetative multiplication of tissue culture plants
(B) Industrial fermentation of sugarcane juice for bio-ethanol production
(C) Targeted and precise gene editing in living organisms
(D) Extraction and purification of secondary metabolites from plants

23. In the CRISPR-Cas9 mechanism, the Cas9 protein essentially acts as an:
(A) DNA-dependent RNA polymerase
(B) Circular extrachromosomal plasmid
(C) Synthetic artificial chromosome
(D) Endonuclease cutting DNA

24. Choose the correct order of the standard stages involved in micropropagation:
(A) Establishment of culture → Hardening → Multiplication → Rooting
(B) Establishment of culture → Multiplication → Rooting → Hardening
(C) Rooting → Establishment of culture → Multiplication → Hardening
(D) Multiplication → Rooting → Hardening → Establishment of culture

25. The predominant use of sugarcane micropropagation in the sugarcane industry is to:
(A) Extract high concentrations of sucrose directly from cell cultures
(B) Rapidly multiply disease-free seed-cane for planting
(C) Produce refined commercial sugar directly without industrial milling
(D) Eradicate invasive weed species across commercial sugarcane fields

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26. Which of the following plant growth regulators must be maintained at a high concentration relative to auxins to promote shoot multiplication in tissue culture?
(A) Gibberellins
(B) Cytokinins
(C) Abscisic acid
(D) Ethylene

27. Match the biotechnological tools in List I with their primary applications in List II.
List I: (Biotechnological Tool)
P. PCR
Q. Gel Electrophoresis
R. Gene Gun
S. Autoclave
List II: (Application)
1. Direct gene transfer into plant cells
2. Amplification of specific DNA segments
3. Sterilization of glassware and media
4. Separation of DNA fragments by size
(A) P-2, Q-4, R-1, S-3
(B) P-4, Q-2, R-1, S-3
(C) P-2, Q-1, R-4, S-3
(D) P-3, Q-4, R-1, S-2

28. In India, the apex regulatory body responsible for the approval of commercial cultivation of genetically modified crops is:
(A) ICAR (Indian Council of Agricultural Research)
(B) NBPGR (National Bureau of Plant Genetic Resources)
(C) GEAC (Genetic Engineering Appraisal Committee)
(D) FSSAI (Food Safety and Standards Authority of India)

29. The GEAC (Genetic Engineering Appraisal Committee) functions under the administrative control of which Ministry in India?
(A) Ministry of Agriculture and Farmers Welfare
(B) Ministry of Science and Technology
(C) Ministry of Commerce and Industry
(D) Ministry of Environment, Forest and Climate Change

(A) P-3, Q-1, R-2, S-4
(B) P-3, Q-2, R-1, S-4
(C) P-1, Q-3, R-2, S-4
(D) P-4, Q-1, R-3, S-2

50. Dhara Mustard Hybrid-11 (DMH-11), a genetically modified crop developed in India, utilizes which gene system for pollination control and hybridization?
(A) Cry1Ac and Cry2Ab system
(B) Cas9 and sgRNA system
(C) Barnase and Barstar system
(D) EPSPS herbicide tolerance system

51. In genetic engineering, selectable marker genes (such as antibiotic resistance genes) are primarily used to:
(A) Identify and select transformed host cells
(B) Directly increase the photosynthetic efficiency and yield of plants
(C) Act as site-specific molecular scissors to cut target genomic DNA
(D) Facilitate physical transfer of target genes into plant nuclei

52. Which enzyme is essential in recombinant DNA technology to form phosphodiester bonds and join two pieces of DNA together?
(A) DNA Helicase
(B) Restriction Endonuclease
(C) Taq Polymerase
(D) DNA Ligase

53. The process of transferring growing tissues or shoots from an exhausted culture medium to a fresh medium during micropropagation is termed:
(A) Protoplast fusion
(B) Sub-culturing
(C) Electroporation
(D) Phenotyping

54. Consider the following applications of DNA fingerprinting in agriculture:
I. Confirming the genetic identity of a newly released crop variety.
II. Detecting the presence of specific fungal pathogens in soil visually.
III. Resolving intellectual property (IP) disputes regarding plant breeder's rights.
Which of the above statements is/are correct?
(A) I and II only
(B) II and III only
(C) I and III only
(D) I, II and III

55. RNA interference (RNAi) is a novel biotechnology mechanism successfully used to develop transgenic crop plants resistant to:
(A) Foliar fungal blights
(B) Vascular bacterial wilts
(C) Soil micronutrient deficiency
(D) Root-knot nematodes

56. Vesicular Arbuscular Mycorrhiza (VAM) is a beneficial bio-fertilizer that establishes a symbiotic relationship with plant roots. Its primary agricultural benefit is:
(A) Enhancing root uptake of soil phosphorus
(B) Symbiotically fixing atmospheric nitrogen within cereal crops
(C) Directly synthesizing and secreting toxins to kill caterpillars
(D) Converting soil minerals into synthetic urea for plant growth

57. Which bio-pesticide is highly specific to the control of the gram pod borer (Helicoverpa armigera) in various crops?
(A) Pseudomonas fluorescens bacterial antagonist
(B) HaNPV (Nuclear Polyhedrosis Virus)
(C) Azospirillum lipoferum bio-fertilizer
(D) Phosphate Solubilizing Bacteria (PSB)

58. A key distinction between CRISPR-Cas9 gene editing and traditional transgenic GMOs is that CRISPR:
(A) Always requires inserting foreign genes from completely unrelated species
(B) Edits native genes without requiring foreign DNA insertion
(C) Functions exclusively within cultured animal cells and never in plants
(D) Relies entirely on Agrobacterium vectors for delivering target enzymes

59. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): Biofortification of staple crops is an effective and sustainable strategy to combat hidden hunger and micronutrient deficiencies in developing nations.
Reason (R): Biofortified crops require patients to consume them as medicinal supplements rather than as regular food.
(A) Both Assertion (A) and Reason (R) are true

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CHAPTER 09
Agricultural Biotechnology

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1. The primary objective of applying biotechnology in modern agriculture is to:
(A) Develop crop varieties with higher yield, better quality, and disease resistance
(B) Replace traditional ploughing methods with mechanized tillage
(C) Increase chemical pesticide consumption in farming
(D) Completely eliminate the need for irrigation in all crops

2. The inherent capability of a single plant cell to divide and develop into a complete whole plant is termed as:
(A) Pluripotency
(B) Organogenesis
(C) Totipotency
(D) Embryogenesis

3. In the process of plant tissue culture, any part of the plant used to initiate the culture is known as:
(A) Explant
(B) Callus
(C) Propagule
(D) Inoculum

4. Which specific plant tissue culture technique is most widely utilized to produce virus-free sugarcane planting material?
(A) Anther culture
(B) Pollen culture
(C) Protoplast fusion
(D) Apical meristem culture

5. Micropropagation is an advanced agricultural technique defined as:
(A) The propagation of microorganisms for bio-fertilizer production
(B) The large-scale vegetative multiplication of plants in vitro under aseptic conditions
(C) The process of modifying genes using CRISPR technology
(D) The cultivation of crops using micro-irrigation systems

6. During plant tissue culture, standard sterilization of culture media is achieved using an autoclave at:
(A) 100 °C at 10 ψ for 10 minutes
(B) 121 °C at 15 ψ for 15-20 minutes
(C) 150 °C at 20 ψ for 30 minutes
(D) 180 °C at 15 ψ for 5 minutes

7. The unorganized, undifferentiated mass of cells produced during plant tissue culture is called:
(A) Somatic embryo
(B) Cybrid
(C) Chimera
(D) Callus

8. Match the biotechnological terms in List I with their corresponding definitions in List II.
List I: (Biotechnological Term)
P. Explant
Q. Totipotency
R. Callus
S. Somaclones
List II: (Definition)
1. Undifferentiated mass of dividing cells
2. Plants genetically identical to the original plant
3. Plant part excised for tissue culture
4. Ability of a cell to grow into a whole plant
(A) P-3, Q-4, R-1, S-2
(B) P-4, Q-3, R-1, S-2
(C) P-3, Q-1, R-4, S-2
(D) P-1, Q-4, R-3, S-2

9. Which soil bacterium is widely recognized as the "natural genetic engineer" of plants due to its ability to transfer DNA into plant genomes?
(A) Rhizobium leguminosarum
(B) Agrobacterium tumefaciens
(C) Azotobacter chroococcum
(D) Bacillus subtilis

10. Bt cotton is a genetically modified crop engineered primarily to resist which of the following pests?
(A) Sucking pests like whitefly and jassids
(B) Bollworms (Lepidopteran pests)
(C) Root-knot nematodes

(A) Isolation of target gene → Digestion by restriction enzymes → Ligation into vector → Transformation into host → Screening
(B) Digestion by restriction enzymes → Isolation of target gene → Transformation into host → Ligation into vector → Screening
(C) Ligation into vector → Isolation of target gene → Transformation into host → Screening → Digestion by restriction enzymes
(D) Transformation into host → Screening → Ligation into vector → Isolation of target gene → Digestion by restriction enzymes

69. Embryo rescue is a specialized plant tissue culture technique predominantly used to:
(A) Accelerate the germination rate and vigor of dormant but viable seeds
(B) Rescue viable plants from interspecific crosses where embryos abort
(C) Eradicate systemic viral pathogens from infected somatic plant cells
(D) Artificially induce early flowering in short-day crops during summer

70. Consider the following successful examples of crop biofortification:
I. Golden Rice enriched with Provitamin A.
II. Iron and Zinc enriched wheat varieties (like WB 02).
III. Quality Protein Maize (QPM) enriched with essential amino acids lysine and tryptophan.
Which of the above statements is/are correct?
(A) I and II only
(B) II and III only
(C) I and III only
(D) I, II and III

71. Seeds that cannot tolerate desiccation and extreme cold temperatures, and therefore cannot be conserved in conventional seed gene banks, are called:
(A) Desiccation-tolerant orthodox seeds
(B) Encapsulated synthetic seeds
(C) Genetically pure breeder seeds
(D) Recalcitrant seeds

72. Establishing micropropagation tissue culture laboratories inside cooperative sugar mill zones primarily targets the regular supply of:
(A) Genetically pure, healthy seed cane for higher yields
(B) Heavy mechanized agricultural equipment directly to smallholder farmers
(C) Broad-spectrum chemical pesticides and fertilizers at subsidized rates
(D) Modern small-scale jaggery and khandsari industrial processing units

73. A 'Cybrid' (Cytoplasmic Hybrid) in agricultural biotechnology is created by fusing:
(A) Two fully intact somatic protoplasts containing both original nuclei
(B) An enucleated protoplast with a nucleated protoplast
(C) Viable pollen grains directly onto receptive stigmas of alien plants
(D) Plasmids isolated from two distinct and unrelated bacterial species

74. QTL (Quantitative Trait Locus) mapping using molecular markers is extremely valuable to agricultural breeders because it helps in tracking and improving:
(A) Simple monogenic qualitative traits controlled by a single gene, such as flower color
(B) Complex polygenic traits like yield and stress tolerance
(C) The uptake efficiency and utilization of inorganic chemical fertilizers in fields
(D) Physical seed lot purity together with standard laboratory germination percentage

75. Liquid bio-fertilizers are increasingly preferred over traditional carrier-based (powdered) bio-fertilizers because they have:
(A) Longer shelf life and higher cell survival in field conditions
(B) Do not rely on living beneficial microorganisms for their biological activity
(C) Completely eliminate all operational requirements for crop field irrigation
(D) Can be safely combined directly with concentrated synthetic chemical weedicides

76. One of the major technical limitations or risks associated with gene editing technologies like CRISPR is:
(A) Total structural destruction and degradation of host cell mitochondria
(B) Total physiological inability to function within agricultural crop plants
(C) Off-target mutations at unintended genomic locations
(D) Requirement of extremely high thermal conditions to activate Cas9 enzymes

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tumor-inducing plasmid capable of transferring a specific segment, known as transfer DNA, into the nuclear genome of host plant cells. Genetic engineers utilize modified disarmed plasmids of Agrobacterium tumefaciens to introduce target genes into plant genomes.

10. (B) Bollworms (Lepidopteran pests)
Bt cotton is a genetically modified crop engineered to express crystal proteins derived from soil bacteria, specifically targeting lepidopteran insect pests such as cotton bollworms. Upon ingestion by susceptible larvae, these crystalline delta-endotoxins solubilize within the alkaline environment of the insect midgut, binding to specific receptors and creating lethal micro-pores that cause pest mortality.

11. (A) Bacillus thuringiensis
The insect resistance exhibited by Bt cotton originates from specific cry genes isolated from the Gram-positive soil bacterium Bacillus thuringiensis. This bacterium naturally produces crystalline delta-endotoxin proteins during sporulation. When these cry genes are inserted into the cotton plant genome, the plant expresses insecticidal proteins that selectively destroy the gut membranes of feeding lepidopteran caterpillars.

12. (A) I and II only
Genetically modified crops are engineered by integrating foreign functional DNA into host genomes to impart targeted traits. In India, Bt cotton remains the sole genetically modified crop cleared for commercial cultivation. Genetically modified crops are designed to optimize resource efficiency or pest resistance and do not inherently mandate higher doses of chemical fertilizers compared to traditional varieties.

13. (D) Molecular scissors that cut DNA at specific sequences
Restriction endonucleases function as precise molecular scissors in recombinant DNA technology. These specialized bacterial enzymes recognize short, specific double-stranded nucleotide sequences known as restriction sites and cleave phosphodiester bonds at or near these locations. This site-specific cleavage generates defined DNA fragments with either sticky or blunt ends, facilitating the isolated insertion of target genes.

14. (C) Extra-chromosomal, circular bacterial DNA molecules
Plasmids are extra-chromosomal, small, circular double-stranded DNA molecules found naturally within bacterial cells that replicate independently of the chromosomal DNA. Because of their ability to autonomous replication, ease of genetic manipulation, and inclusion of selectable markers, plasmids serve as fundamental gene transfer vectors in plant biotechnology, delivering foreign genetic constructs into host plant genomes effectively.

15. (A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
Apical meristem culture is widely deployed to regenerate virus-free sugarcane planting material. The dome of the shoot apical meristem remains systematically uninfected because its intense cellular division rate outpaces viral replication mechanisms. Furthermore, the absence of differentiated vascular tissues like xylem and phloem prevents systemic viral movement into the meristematic zone, ensuring virus-free regenerated plantlets.

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16. (D) Restriction Fragment Length Polymorphism
RFLP stands for Restriction Fragment Length Polymorphism, which represents one of the earliest molecular marker techniques used in plant genetics. This method detects genomic variation by digesting DNA with restriction endonucleases and analyzing the resulting fragment length variations via gel electrophoresis and hybridization probes. RFLP markers aid in mapping genes and constructing linkage maps.

17. (A) Select target traits early in seedlings without waiting for plant maturity
Marker-Assisted Selection utilizes DNA markers linked tightly to desirable agronomic traits to select superior genotypes early during seedling development. Breeders analyze DNA extracted from young plant tissues, allowing accurate selection without waiting for maturity or phenotypic expression. This approach significantly accelerates breeding cycles, eliminates environmental influence, and increases selection efficiency for complex quantitative traits.

ANSWERS

1. (A) Develop crop varieties with higher yield, better quality, and disease resistance
The primary objective of applying biotechnology in modern agriculture centers on enhancing overall crop performance and productivity. Modern agricultural biotechnology utilizes tools such as genetic modification, tissue culture, and molecular markers to develop crop varieties with elevated yields. These advanced crop varieties demonstrate superior nutritional quality, biotic disease resistance, and abiotic stress tolerance, thereby reducing reliance on chemical inputs.

2. (C) Totipotency
Totipotency refers to the inherent biological capacity of a single live plant cell to divide, differentiate, and regenerate into a complete, fully functional whole plant organism. This cellular capability forms the fundamental physiological foundation for all plant tissue culture techniques. In suitable artificial growth media containing essential nutrients and phytohormones, totipotent plant cells undergo organogenesis or somatic embryogenesis.

3. (A) Explant
An explant is defined as any excised segment of tissue or organ taken from a donor plant to initiate an in vitro tissue culture. Common explants include shoot tips, nodal segments, leaf discs, root fragments, and floral tissues. Prior to culture initiation, explants undergo surface sterilization to eliminate external pathogens before placement on a nutrient-rich, sterile medium.

4. (D) Apical meristem culture
Apical meristem culture is the primary tissue culture technique utilized to produce virus-free planting material in sugarcane and other vegetatively propagated crops. The actively growing apical dome lacks functional vascular tissues, and its rapid cell division rate outpaces viral replication and systemic invasion. Culturing this virus-free meristematic dome enables the regeneration of healthy plantlets that maintain vigour.

5. (B) The large-scale vegetative multiplication of plants in vitro under aseptic conditions
Micropropagation refers to the rapid, large-scale vegetative multiplication of plants using tissue culture techniques under controlled in vitro aseptic conditions. By culturing excised plant tissues on nutrient media enriched with balanced plant growth regulators, thousands of true-to-type, disease-free plantlets can be generated from a single explant within a limited timeframe, overcoming traditional propagation constraints.

6. (B) 121 °C at 15 ψ for 15-20 minutes
Standard heat-moist sterilization of tissue culture media, glassware, and heat-stable equipment is achieved using an autoclave operating at 121 °C under 15 pounds per square inch of steam pressure for a duration of 15 to 20 minutes. These specific physical parameters effectively denature proteins, destroying all viable bacterial spores, vegetative micro-organisms, fungal spores, and viruses.

7. (D) Callus
A callus is an unorganized, unspecialized, and rapidly dividing mass of parenchymatous plant cells generated during in vitro tissue culture. Callus formation is induced when explants are cultivated on a nutrient medium containing an appropriate physiological balance of auxins and cytokinins. Callus tissue can subsequently undergo organogenesis or somatic embryogenesis to differentiate into shoots and roots.

8. (A) P-3, Q-4, R-1, S-2
In agricultural biotechnology, an explant is a plant part excised to initiate tissue culture, while totipotency defines the intrinsic ability of a single plant cell to develop into an entire organism. Callus represents an unorganized mass of actively dividing undifferentiated cells. Somaclones refer to plants regenerated in vitro that are genetically identical to the original plant.

9. (B) Agrobacterium tumefaciens
Agrobacterium tumefaciens is a naturally occurring soil bacterium widely designated as nature's genetic engineer of plants. It possesses a

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77. Which biotechnology method provides a solution to overcome severe sexual incompatibility barriers between two distantly related plant species?
(A) Traditional pedigree selection breeding
(B) Conventional pure line selection method
(C) Standard bulk population breeding method
(D) Somatic hybridization

78. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): Somatic hybridization allows the crossing of plant species that cannot cross-pollinate naturally.
Reason (R): Somatic hybridization involves the physical fusion of isolated protoplasts of two different plants, completely bypassing natural floral mechanisms.
(A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
(B) Both Assertion (A) and Reason (R) are true but R is not the correct explanation of A.
(C) Assertion (A) is true but Reason (R) is false.
(D) Assertion (A) is false but Reason (R) is true.

79. The use of molecular markers (like SSRs) helps ensure the distinctness, uniformity, and stability (DUS) of a new sugarcane variety. Why is DUS testing important?
(A) It directly determines total recoverable sugar percentage during industrial mill processing
(B) It is required for variety registration under the PPV&FR Act
(C) It completely eliminates field application requirements for nitrogenous chemical fertilizers
(D) It dictates the exact statutory minimum price per quintal set by government agencies

80. Identify the odd one out among the following genetic engineering and tissue culture tools:
(A) Restriction Endonuclease
(B) DNA Ligase
(C) Plasmid Vector
(D) Laminar Air Flow

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18. (C) Crops expressing a foreign gene inserted from another species
Transgenic crops are plants that have been genetically modified using recombinant DNA technology to incorporate and stably express specific target genes isolated from unrelated species, organisms, or microbes. These introduced foreign genes, termed transgenes, confer desirable novel characteristics lsuch as insect resistance, herbicide tolerance, or enhanced nutritional profiles that cannot be easily introduced conventionally.

19. (A) Rhizobium
Rhizobium is a genus of nitrogen-fixing bacteria widely applied as a bio-fertilizer seed treatment for leguminous crops. It establishes a mutualistic symbiotic association inside the root nodules of host legumes, where it converts atmospheric nitrogen gas into plant-absorbable ammonium ions. Seed inoculation with Rhizobium cultures enhances soil fertility, reduces synthetic nitrogen requirements, and boosts productivity.

20. (B) I, II and IV only
Trichoderma viride is a biological control agent that manages soil-borne fungal pathogens through mycoparasitism and antibiosis. Vesicular Arbuscular Mycorrhiza forms symbiotic relationships with roots to enhance phosphorus absorption. Nuclear Polyhedrosis Virus serves as a host-specific bio-pesticide targeting lepidopteran larvae. Azotobacter is a free-living, non-symbiotic nitrogen-fixing bacterium utilized primarily in non-leguminous crop ecosystems.

21. (B) Trichoderma harzianum / viride
Species of Trichoderma, such as Trichoderma harzianum and Trichoderma viride, are potent bio-fungicides widely recommended for controlling soil-borne sugarcane pathogens like Colletotrichum falcatum, the causal agent of Red Rot. Treating seed setts or soil with Trichoderma formulations suppress pathogen growth through direct hyphal mycoparasitism, competitive exclusion, secretion of cell wall-degrading enzymes, and induced resistance.

22. (C) Targeted and precise gene editing in living organisms
The CRISPR-Cas9 system represents a revolutionary genome editing technology capable of introducing highly precise, targeted site-specific modifications within host DNA sequences. Utilizing a single guide RNA molecule to direct the Cas9 bacterial endonuclease enzyme to exact genomic coordinates, scientists can induce double-strand DNA breaks to silence, insert, or precisely modify target genes in crops.

23. (D) Endonuclease cutting DNA
In the CRISPR-Cas9 genome editing complex, Cas9 functions structurally and functionally as an RNA-guided endonuclease enzyme. Guided by a complementary single guide RNA sequence, the Cas9 protein identifies matching target DNA sequences adjacent to a protospacer adjacent motif, binding and cleaving both strands of host genomic DNA to create precise double-strand breaks.

24. (B) Establishment of culture → Multiplication → Rooting → Hardening
Micropropagation follows a standardized four-stage sequence for tissue culture production. The process begins with establishment of culture using sterile explants on suitable growth media, followed by shoot multiplication using high cytokinin concentrations. Next, shoot isolates undergo rooting transferred to auxins-rich media, and finally, regenerated plantlets undergo hardening or acclimatization in greenhouses to survive field conditions.

25. (B) Rapidly multiply disease-free seed-cane for planting
The sugarcane industry relies on micropropagation primarily to rapidly multiply high-quality, genetically pure, and disease-free seed cane on a commercial scale. Sugarcane is vegetatively propagated and susceptible to systemic seed-borne pathogens like Red Rot and Grassy Shoot Disease. Micropropagation allows rapid clonal expansion of elite healthy seed nursery stocks, significantly enhancing field yields and purity.

26. (B) Cytokinins
In plant tissue culture, organogenesis and shoot proliferation are regulated by the relative balance between plant growth regulators. Maintaining a high concentration of cytokinins relative to auxins in the culture medium promotes shoot bud initiation and rapid shoot multiplication. Cytokinins drive active cell division and shoot apical meristem development while suppressing apical dominance.

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27. (A) P-2, Q-4, R-1, S-3
Polymerase Chain Reaction is utilized for amplifying specific DNA sequences, while agarose gel electrophoresis separates DNA fragments according to size. The gene gun delivers foreign recombinant DNA directly into target plant cells via high-velocity microprojectiles. An autoclave utilizes high-pressure steam to perform heat sterilization of culture media, glassware, and equipment.

28. (C) GEAC (Genetic Engineering Appraisal Committee)
The Genetic Engineering Appraisal Committee represents the statutory apex regulatory authority in India responsible for approving activities involving the large-scale environmental release and commercial cultivation of genetically modified organisms and crops. Operating under biosafety rules, GEAC evaluates environmental safety, food safety assessments, and ecological impact data prior to granting commercial approvals.

29. (D) Ministry of Environment, Forest and Climate Change
The Genetic Engineering Appraisal Committee functions under the administrative jurisdiction of the Ministry of Environment, Forest and Climate Change, Government of India. Established pursuant to the Rules for the Manufacture, Use, Import, Export and Storage of Hazardous Microorganisms, Genetically Engineered Organisms or Cells, 1989 under the Environment Protection Act, 1986, it regulates biosafety assessments.

30. (C) Prevent potential risks of GMOs to human health and the environment
Biosafety guidelines and regulatory frameworks in agricultural biotechnology are established primarily to evaluate, minimize, and prevent potential safety risks that genetically modified organisms might pose to human health, animal welfare, biodiversity, and ecosystem stability. Regulatory oversight ensures rigorous toxicological, allergenicity, and environmental impact assessments before granting field trial or commercial clearance.

31. (D) I, II and III
Biosafety governance is governed by international and national legal frameworks. The Cartagena Protocol regulates transboundary movements of living modified organisms to protect biodiversity. In India, field testing of genetically engineered crops requires formal regulatory approvals from regulatory bodies such as RCGM and GEAC, functioning under the Environment Protection Act of 1986 as the principal legislation.

32. (D) Drought, salinity, and cold stress
DREB, representing Dehydration-Responsive Element-Binding transcription factors, plays a vital regulatory role in plant responses to abiotic environmental stresses. Expression of DREB genes activates downstream stress-responsive physiological pathways that confer tolerance against severe drought, soil salinity, and freezing temperatures. Incorporating DREB genes via genetic engineering enables crop survival and yield stability under challenging climatic conditions.

33. (A) Genetic purity of the seed lot
DNA fingerprinting is increasingly replacing the traditional Grow Out Test in seed certification programs for evaluating the genetic purity of seed lots. Unlike Grow Out Tests, which require growing plants to maturity over an entire season, DNA fingerprinting uses molecular markers to deliver rapid, accurate, environmental-independent verification of varietal identity and genetic purity within hours.

34. (C) SSR (Simple Sequence Repeats)
Simple Sequence Repeats, also termed microsatellites, are short, tandemly repeated DNA sequence motifs distributed throughout eukaryotic genomes. Due to high mutation rates in repeat lengths, SSR loci display high allelic polymorphism between individuals. Polymerase Chain Reaction amplification of SSR loci generates precise locus-specific genomic profiles, making SSRs the preferred molecular marker system.

35. (A) New Delhi
The ICAR-National Institute for Plant Biotechnology is located at Pusa Campus in New Delhi. Formerly known as the National Research Centre on Plant Biotechnology, NIPB serves as a premier research institute dedicated to advanced molecular biology, plant functional genomics, tissue culture, and genetic engineering for crop improvement across various agricultural species.

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36. (D) UPCSR (UP Council of Sugarcane Research), Shahjahanpur
The Uttar Pradesh Council of Sugarcane Research, located in Shahjahanpur, is a prominent state agricultural research institute established to conduct breeding, agronomic, and crop protection research on sugarcane. UPCSR focuses specifically on developing high-yielding, high-sugar, cold-tolerant, and disease-resistant sugarcane varieties customized for agro-climatic conditions prevalent across subtropical regions of Northern India.

37. (B) Emasculation
Emasculation refers to the deliberate surgical or physical removal of anthers or male reproductive organs from bisexual flowers prior to dehiscence and pollen shedding. Performed during artificial hybridization programs, emasculation prevents self-pollination, thereby ensuring that target female parent flowers receive desired pollen exclusively from selected male parents during controlled cross-pollination operations.

38. (A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
Commercial adoption of Bt cotton has significantly reduced synthetic broad-spectrum chemical insecticide applications in cotton ecosystems. Bt cotton plants continuously express crystalline insecticidal proteins, such as Cry1Ac, which specifically kill major lepidopteran pests including pink bollworms upon ingestion. Consequently, farmers require fewer topical chemical pesticide sprays, promoting pest management and protecting non-target organisms.

39. (D) Somaclonal variations
Somaclonal variation refers to genetic and phenotypic variations that arise spontaneously among plantlets regenerated from cell or tissue cultures in vitro. Induced by stress factors during culture steps, chromosomal rearrangements, gene mutations, or epigenetic alterations occur in undifferentiated callus cells. Somaclonal variation serves as a valuable source of novel genetic variability.

40. (A) Provides genetic variability to select traits like disease resistance
Somaclonal variation provides plant breeders with novel genetic variability without relying on sexual hybridization. By subjecting cell or callus cultures to in vitro selection pressures, such as pathogen toxins, high salinity, or drought agents, mutant cell lines exhibiting beneficial mutations can be isolated. Plants regenerated from these lines frequently express improved disease resistance.

41. (B) Biofortification
Biofortification refers to the process of enhancing the nutritional quality of food crops through agronomic practices, conventional plant breeding, or modern biotechnology techniques. By targeting essential micronutrients, vitamins, and high-quality proteins, biofortified crops increase nutrient density within edible plant tissues, offering a sustainable, cost-effective agricultural strategy to combat widespread micronutrient deficiencies.

42. (A) II, IV, I, III
Recombinant DNA technology follows a systematic sequence of molecular operations. First, the desired target gene or DNA fragment is isolated from donor source tissue. Next, this fragment is ligated into a suitable vector construct. The resulting recombinant DNA construct is transformed into recipient host cells, after which transformed cells undergo selection and screening.

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43. (A) Provitamin A (Beta-carotene)
Golden Rice is a genetically modified rice variety biofortified to biosynthesize beta-carotene, a primary precursor of vitamin A, within its edible endosperm tissue. Engineered by inserting phytoene synthase and carotene desaturase genes, the rice grain accumulates yellow-pigmented carotenoids, offering a viable nutritional intervention to alleviate widespread vitamin A deficiency across rice-dependent populations.

44. (C) -196 °C
Cryopreservation involves storing ultra-clean plant germplasm, cell cultures, shoot tips, or seeds in liquid nitrogen at an ultra-low temperature of -196 °C. At this temperature, all internal cellular metabolic activities, enzyme reactions, and cell division processes cease completely, enabling long-term conservation of crop genetic resources without genetic alterations or loss of viability.

45. (B) I, II and IV only
Gene banks preserve crop genetic diversity to support ongoing plant breeding efforts. The National Bureau of Plant Genetic Resources manages India's national gene bank depository. Cryopreservation effectively conserves vegetative germplasm such as shoot tips. However, recalcitrant seeds cannot withstand desiccation or low-temperature seed vault storage, requiring in vitro or field gene bank preservation.

46. (C) Root initiation
During the final stages of sugarcane micropropagation, micro-shoots regenerated during multiplication steps are transferred to a rooting medium containing high auxins concentrations, such as naphthaleneacetic acid or indole-3-butyric acid. Auxins promote cell elongation, adventitious root initiation, and lateral root system development, transforming isolated shoots into fully rooted plantlets ready for hardening.

47. (B) Acclimatization (Hardening)
Acclimatization, commonly known as hardening, is the essential transitional phase in micropropagation where heterotrophic in vitro plantlets adapt to ex vitro environmental conditions. Plantlets transferred from controlled culture vessels gradually adjust to lower relative humidity, higher light intensity, and autotrophic growth conditions, promoting epicuticular wax development and functional stomatal regulation prior to transfer.

48. (D) Bt Cotton
Bt cotton was approved as the first genetically modified crop for commercial cultivation in India by the Genetic Engineering Appraisal Committee in 2002. Incorporating the bacterial cry1Ac gene from Bacillus thuringiensis, Bt cotton confers systemic resistance against destructive bollworms, transforming pest management and significantly boosting cotton productivity across major farming states in India.

49. (A) P-3, Q-1, R-2, S-4
The National Bureau of Plant Genetic Resources is headquartered in New Delhi, while the Sugarcane Breeding Institute is located in Coimbatore. The Uttar Pradesh Council of Sugarcane Research operates from Shahjahanpur, and the National Sugar Institute is established in Kanpur. These institutes provide fundamental research support for germplasm conservation, breeding, and processing.

50. (C) Barnase and Barstar system
Dhara Mustard Hybrid-11, a genetically modified mustard hybrid developed in India, utilizes the genetic Barnase-Barstar system derived from Bacillus amyloliquefaciens for pollination control. The Barnase gene induces male sterility in the female line by disrupting tapetum cells, while the Barstar gene restores fertility in the male parent line, enabling efficient hybrid seed production.

51. (A) Identify and select transformed host cells
Selectable marker genes, such as antibiotic or herbicide resistance genes, are integrated into recombinant genetic constructs used in genetic engineering. When transforming host plant tissues, only cells that successfully incorporate the vector construct express the marker gene. Placing tissues on selection media containing antibiotics or herbicides allows surviving transformed cells to be identified.

52. (D) DNA Ligase
DNA ligase is an essential enzyme in recombinant DNA technology that functions as molecular glue. It catalyzes the formation of covalent phosphodiester bonds between adjacent 3'-hydroxyl and 5'-phosphate ends of double-stranded DNA fragments. This ligation process joins target gene inserts into linearized plasmid vectors, creating stable recombinant DNA constructs required for transformation.

53. (B) Sub-culturing
Sub-culturing refers to the transfer of growing tissues, callus mass, or proliferating micro-shoots from an exhausted culture medium onto fresh, sterile nutrient media. Performed periodically during tissue culture operations, sub-culturing prevents nutrient depletion, eliminates accumulated toxic metabolic byproducts, maintains cellular vigour, and promotes continuous multiplication and development of in vitro plant cultures.

54. (C) I and III only
DNA fingerprinting provides precise molecular identification in agricultural systems. It confirms the genetic identity and purity of newly released crop varieties by generating distinct genomic profiles independent of environmental variables.

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Furthermore, DNA fingerprinting serves as definitive evidence in intellectual property rights disputes, resolving ownership and varietal protection claims under plant breeder rights frameworks.

55. (D) Root-knot nematodes
RNA interference is a sequence-specific post-transcriptional gene silencing mechanism successfully utilized to engineered nematode resistance in crops. Transgenic plants expressing double-stranded RNA constructs targeting essential housekeeping genes of root-knot nematodes induce targeted mRNA degradation upon parasite ingestion. This inhibits nematode growth, feeding, and reproduction, effectively protecting plant root systems from severe infection.

56. (A) Enhancing root uptake of soil phosphorus
Vesicular Arbuscular Mycorrhiza forms a mutualistic symbiotic association with plant roots. The extensive extraradical fungal hyphae network explores soil zones beyond the depletion zone, absorbing immobile nutrients, particularly inorganic phosphorus, and transporting them directly into host root cortical cells. In return, host plants provide carbohydrates, resulting in improved root development and stress tolerance.

57. (B) HaNPV (Nuclear Polyhedrosis Virus)
Helicoverpa armigera Nuclear Polyhedrosis Virus is a highly host-specific entomopathogenic bio-pesticide utilized for managing the destructive gram pod borer. Upon ingestion by feeding larvae, occlusion bodies dissolve within the alkaline larval gut, releasing virions that infect internal tissues. This causes lethargy, tissue breakdown, and liquefaction mortality, providing safe control without impacting beneficial insects.

58. (B) Edits native genes without requiring foreign DNA insertion
A critical distinction between CRISPR-Cas9 genome editing and traditional transgenic technologies lies in the mechanism of modification. Conventional genetic modification requires introducing foreign recombinant DNA from transgenic donor organisms. In contrast, CRISPR-Cas9 allows precise site-directed editing, insertion, deletion, or substitution of native endogenous host genomic sequences without leaving foreign vector DNA.

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59. (C) Assertion (A) is true but Reason (R) is false.
Biofortification represents an agricultural strategy designed to enhance micronutrient levels in staple crops, effectively combating widespread hidden hunger across vulnerable populations. However, biofortified crops are consumed as ordinary daily food staples rather than medicinal supplements, making the strategy highly sustainable, cost-effective, and culturally acceptable for improving public health without requiring diet modification.

60. (C) ELISA and PCR molecular diagnostics
Molecular diagnostic techniques like Enzyme-Linked Immunosorbent Assay and Polymerase Chain Reaction offer sensitive, rapid, and accurate detection of latent sugarcane pathogens, including Red Rot fungus and Grassy Shoot phytoplasma. These assays detect minute quantities of pathogen antigens or specific DNA sequences in planting setts well before visual symptoms appear, preventing field outbreaks.

61. (D) P-2, Q-3, R-4, S-1
Trichoderma harzianum functions as a potent biological fungicide targeting soil-borne plant diseases, while Azotobacter represents a free-living nitrogen-fixing soil bacterium. Bacillus thuringiensis acts as a bacterial bio-pesticide producing crystalline endotoxins against caterpillars, and Beauveria bassiana serves as an entomopathogenic fungus that infects target insect pests through cuticular penetration and internal colonization.

62. (C) Delay Bt toxin resistance in bollworm populations
Planting non-Bt cotton refuge lines surrounding Bt cotton fields is a mandatory resistance management strategy. The refuge area allows susceptible insect pests to survive and mate with any rare resistant pests emerging from the Bt crop area. Diluting resistant alleles in pest populations delays the development of pest resistance against expressed Bt endotoxins.

63. (B) Safely containing biological agents and GMOs to prevent environmental escape
Biosafety Level containment facilities are specialized laboratory structures designed to safely isolate biological agents, modified microbes, and genetically modified organisms. Incorporating controlled airflow systems, HEPA filtration, specialized waste decontamination

units, and physical barriers, BSL facilities prevent unintended environmental escape and protect lab personnel from potential biohazard risks during research activities.

64. (D) It renders harvested seeds sterile, preventing seed saving and reuse
Genetic Use Restriction Technology, commonly known as terminator technology, involves genetically modifying plants to produce sterile seeds in the harvested crop. While protecting proprietary intellectual property rights of seed developers, this technology prevents farmers from saving and re-sowing seeds from their harvests, forcing dependence on commercial seed suppliers for purchasing new seed stocks.

65. (A) Simple Sequence Repeats (SSRs)
Microsatellites are structurally defined as Simple Sequence Repeats containing short tandem nucleotide repeat motifs. Due to variations in the number of repeat units across individuals, SSR markers exhibit high polymorphism, codominant inheritance, and uniform genomic distribution. These features make SSRs an ideal molecular tool for plant genome mapping and DNA fingerprinting.

66. (B) II and IV only
Somaclonal variation occurs spontaneously among tissue culture-regenerated plants, making it an unpredictable genetic event rather than a planned outcome. It is highly beneficial for sugarcane improvement, enabling selection of cell variants resistant to Red Rot or tolerant to salinity. Thus, statements asserting that somaclonal variation is predictable and useless are incorrect.

67. (A) Somatic embryos encapsulated in sodium alginate gel
Synthetic seeds, also termed artificial seeds, are produced by encapsulating somatic embryos, micro-shoots, or axillary buds within a protective hydrogel matrix, typically sodium alginate paired with calcium chloride complexation. Enriched with nutrients, plant growth regulators, and fungicides, synthetic seeds function as functional propagules for large-scale handling, storage, and direct planting of genotypes.

68. (A) Isolation of target gene → Digestion by restriction enzymes → Ligation into vector → Transformation into host → Screening
The standard protocol for gene cloning begins with isolating the desired target DNA fragment from donor tissue. The DNA and vector are digested using specific restriction enzymes to generate compatible ends. Next, the target gene is ligated into the vector construct, transformed into host cells, and screened to confirm successful recombinants.

69. (B) Rescue viable plants from interspecific crosses where embryos abort
Embryo rescue is an in vitro tissue culture technique used to salvage immature hybrid embryos that would otherwise degenerate due to endosperm incompatibility. Excising and culturing immature embryos on a nutrient-rich artificial medium bypasses post-zygotic hybridization barriers, enabling the successful production of viable interspecific or intergeneric hybrid plants in crop breeding.

70. (D) I, II and III
Biofortification successfully enhances the essential nutrient profile of major agricultural staple crops. Prominent examples include Golden Rice enriched with provitamin A beta-carotene, biofortified wheat cultivars such as WB 02 containing elevated iron and zinc concentrations, and Quality Protein Maize hybrids possessing significantly elevated concentrations of essential amino acids lysine and tryptophan.

71. (D) Recalcitrant seeds
Recalcitrant seeds are desiccation-sensitive seeds that lose viability rapidly when moisture content drops below a critical threshold. Unlike orthodox seeds, recalcitrant seeds cannot survive dehydration or freezing temperatures, preventing long-term conservation in standard seed banks. Preserving germplasm of recalcitrant crop species requires alternative methodologies such as cryopreservation, in vitro culture, or field gene banks.

72. (A) Genetically pure, healthy seed cane for higher yields
Establishing micropropagation facilities within cooperative sugar mill zones ensures a consistent local supply of high-quality, genetically pure, disease-free seed cane for member farmers. Utilizing clean tissue culture plantlets

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prevents the widespread dissemination of seed-borne diseases like Red Rot, enhancing field germination, stalk density, cane yield tonnage, and overall sugar recovery rates.

73. (B) An enucleated protoplast with a nucleated protoplast
A cybrid, or cytoplasmic hybrid, is formed by fusing an enucleated protoplast derived from one plant with a fully nucleated protoplast from another species. This somatic hybridization process combines nuclear genes from a single donor parent with cytoplasm and organelle genomes, such as chloroplasts or mitochondria, from both parents, transferring cytoplasmically inherited traits.

74. (B) Complex polygenic traits like yield and stress tolerance
Quantitative Trait Loci mapping uses molecular markers to identify genomic regions associated with complex polygenic traits. Unlike qualitative traits controlled by single genes, agricultural traits such as crop yield, drought tolerance, and salinity resistance are governed by multiple genes interacting with environmental factors. QTL mapping enables targeted marker-assisted selection for improving polygenic traits.

75. (A) Longer shelf life and higher cell survival in field conditions
Liquid bio-fertilizers offer significant advantages over conventional carrier-based formulations, including extended shelf life, higher viable microbial cell counts, and improved tolerance to field temperature fluctuations. Formulated with cell protectants and additives, liquid bio-fertilizers maintain microbial physiological activity during storage and application, providing uniform seed coating and enhanced nutrient fixation efficiency.

76. (C) Off-target mutations at unintended genomic locations
A significant technical challenge in applying gene editing technologies such as CRISPR-Cas9 is the occurrence of off-target mutations. These off-target events occur when the Cas9 endonuclease cleaves DNA sequences that closely resemble the target sequence elsewhere in the host genome, potentially causing unintended mutations, gene disruptions, or altered physiological responses.

77. (D) Somatic hybridization
Somatic hybridization provides a biotechnology solution to overcome pre-zygotic and post-zygotic sexual incompatibility barriers between distantly related species. By enzymatically digesting cell walls to isolate protoplasts and inducing enzymatic or electro-fusion, somatic cell hybrids combining genomes from non-interbreedable species can be regenerated into intact plants, transferring beneficial wild gene sources.

78. (A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
Somatic hybridization allows successful hybridization between sexually incompatible plant species that cannot cross-pollinate naturally. This is accomplished by isolating somatic protoplasts from parental cell tissues, removing cell walls, and fusing their plasma membranes physically using polyethylene glycol or electrical pulses. This non-sexual somatic fusion bypasses cross-incompatibility barriers, generating unique somatic hybrids.

79. (B) It is required for variety registration under the PPV&FR Act
DUS testing, evaluating Distinctness, Uniformity, and Stability, is a mandatory regulatory requirement for registering new plant varieties under the Protection of Plant Varieties and Farmers' Rights Act. Utilizing high-resolution molecular markers like SSRs alongside morphological phenotyping ensures that a newly developed sugarcane cultivar is distinctly identifiable, genetically uniform, and stable.

80. (D) Laminar Air Flow
Among the listed items, restriction endonucleases, DNA ligase, and plasmid vectors represent molecular tools directly involved in biochemical genetic engineering procedures. In contrast, Laminar Air Flow cabinets represent physical laboratory apparatus designed to maintain sterile aseptic airflow environments during tissue culture operations, distinguishing them as physical hardware rather than molecular tools.

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ANSWERS

1. (A) Gregor Johann Mendel
Gregor Johann Mendel established the basic principles of heredity through his systematic hybridization experiments on garden pea plants. His discoveries laid the foundation for modern genetics by demonstrating that traits are inherited as discrete units, now known as genes, which follow specific rules of segregation and independent assortment across successive generations.

2. (C) Law of Segregation
The Law of Segregation dictates that allele pairs separate during the formation of gametes, ensuring each gamete receives only one allele for a particular gene. This fundamental principle ensures that offspring inherit one allele from each parent, restoring the diploid state during fertilization and maintaining consistent genetic transmission across generations.

3. (A) Chromosome
Chromosomes serve as the physical structures responsible for carrying genetic material in a linear order within living cells. Formed from organized DNA wrapped around proteins, they replicate during cell division to pass hereditary information accurately from parent organisms to offspring, ensuring the structural stability and continuity of traits across biological generations.

4. (D) Thymine
In double-stranded deoxyribonucleic acid, nitrogenous bases follow strict complementary base pairing driven by specific hydrogen bonding rules. Adenine exclusively pairs with thymine through two hydrogen bonds, whereas guanine pairs with cytosine via three hydrogen bonds. This specific complementary pairing maintains the uniform structural width and thermodynamic stability of the molecular double-helical architecture.

5. (C) I and III only
Ribonucleic acid typically exists as a single-stranded nucleic acid polymer composed of ribose sugar units, distinguishing it from deoxyribonucleic acid. Its nitrogenous base composition includes adenine, guanine, cytosine, and uracil, where uracil replaces thymine. Consequently, claims that it contains deoxyribose are incorrect, making only the single-stranded structure and presence of uracil true.

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6. (C) Creation of variation
Creating genetic variation is the indispensable initial step in any systematic conventional plant breeding programme, as selection requires pre-existing diversity to be effective. Breeders generate new variation through mechanisms such as introduction, hybridization, mutation, or polyploidy before evaluating, selecting, and multiplying superior plant genotypes for crop improvement and agricultural distribution.

7. (D) To significantly improve crop yield, quality, and stress tolerance mechanisms
Plant breeding focuses on altering the genetic architecture of cultivated crops to enhance economic value. The principal objectives involve increasing grain or biomass yield, improving nutritional or processing quality, and imparting resistance to biotic and abiotic stresses. These enhancements ensure sustainable agricultural productivity and food security while tailoring crop cultivars to diverse agro-climatic conditions.

8. (A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
Genetic linkage refers to the physical proximity of two or more genes located on the same chromosome. Because linked genes tend to be physically transmitted together during meiosis, they resist independent assortment. Consequently, tighter genetic linkage directly reduces the frequency of meiotic recombination events, making both statements true with the explanation providing the exact underlying physiological mechanism.

9. (B) Mass selection
Mass selection involves choosing desirable individual plants from a population based exclusively on their phenotypic characteristics and harvesting their seeds in bulk to raise the subsequent generation. It is one of the oldest methods of plant selection, utilized primarily in cross-pollinated and self-pollinated crops to

self-pollinated crops during this process.
IV. It creates new genetic variation in the segregating generations.
Which of the above statements is/are incorrect?
(A) I and II only
(B) III only
(C) II and IV only
(D) I, III and IV

11. Which selection method is most appropriate for crop improvement in vegetatively propagated crops like sugarcane?
(A) Clonal selection
(B) Pure line selection
(C) Mass selection
(D) Progeny selection

12. Match the breeding method in List I with its main application in List II:
List I: (Breeding Method)
P. Pure line selection
Q. Backcross method
R. Heterosis breeding
S. Mutation breeding
List II: (Main Application)
1. Transfer of a single disease resistance gene
2. Creation of new genetic variation using gamma rays
3. Development of uniform self-pollinated varieties
4. Exploitation of hybrid vigour
(A) P-1, Q-3, R-2, S-4
(B) P-3, Q-4, R-1, S-2
(C) P-3, Q-1, R-4, S-2
(D) P-4, Q-1, R-3, S-2

13. In the pedigree method of plant breeding, individual plant selection is initiated in which segregating generation?
(A) F1 generation
(B) F2 generation
(C) F5 generation
(D) F6 generation

14. What is the main purpose of emasculation in artificial hybridization?
(A) To prevent cross-pollination
(B) To induce sterility in the progeny
(C) To prevent self-pollination
(D) To increase the size of the flower

15. Consider the following statements about polyploidy breeding:
I. Polyploids possess more than two complete sets of chromosomes.
II. Colchicine is commonly used to induce polyploidy in plants.
III. Triploid watermelons are fully fertile and produce abundant seeds.
Which of the above statements is/are correct?
(A) I and II only
(B) II and III only
(C) I and III only
(D) I, II and III

16. The phenomenon where an F1 hybrid exhibits superiority over both of its homozygous parents in terms of yield or vigour is known as:
(A) Inbreeding depression
(B) Epistasis
(C) Pleiotropy
(D) Heterosis

17. In self-pollinated crops, continuous selfing over several generations leads to:
(A) Increased homozygosity
(B) Increased heterozygosity
(C) High hybrid vigour
(D) Sterility

18. The process of transferring a disease resistance gene from a wild relative into an established high-yielding commercial variety without altering its other traits is best achieved by:
(A) Bulk method
(B) Pedigree method
(C) Backcross method
(D) Synthetic breeding

19. A plant variety developed to resist a specific strain of a pathogen using major genes often loses its resistance when a new pathogen race evolves. This type of resistance is called:
(A) Vertical resistance
(B) Horizontal resistance
(C) Durable resistance
(D) Polygenic resistance

20. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): Sugarcane breeding in India is predominantly localized in Coimbatore rather than in North Indian states like Uttar Pradesh.
Reason (R): The tropical climatic conditions in Coimbatore are highly favorable for natural flowering (arrowing) and viable seed set in sugarcane.

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propagated through vegetative setts rather than true seeds.

Reason (R): Sugarcane is highly heterozygous, and vegetative propagation ensures the genetic uniformity of commercial clones.

(A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
(B) Both Assertion (A) and Reason (R) are true but R is not the correct explanation of A.
(C) Assertion (A) is true but Reason (R) is false.
(D) Assertion (A) is false but Reason (R) is true.

41. The wild sugarcane species extensively used in early sugarcane breeding programmes to impart resistance against diseases, pests, and environmental stress is:
(A) Saccharum officinarum
(B) Saccharum spontaneum
(C) Saccharum robustum
(D) Saccharum edule

42. Identify the correct order of the stages in a standard plant breeding process aimed at developing a disease-resistant variety:
(A) Selection in segregating generations → Germplasm screening → Yield trials → Crossing with susceptible high-yielder
(B) Germplasm screening → Crossing with susceptible high-yielder → Selection in segregating generations → Yield trials
(C) Yield trials → Crossing with susceptible high-yielder → Selection in segregating generations → Germplasm screening
(D) Crossing with susceptible high-yielder → Yield trials → Germplasm screening → Selection in segregating generations

43. In genetic terms, the specific physical location of a gene on a chromosome is known as its:
(A) Locus
(B) Allele
(C) Centromere
(D) Chromatid

44. Genetic vulnerability in crops, which led to historical disasters like the Irish Potato Famine, is primarily caused by:
(A) Maintaining high levels of genetic diversity within fields
(B) Strategic deployment of multiple major pest-resistant genes
(C) Monoculture of a single genetically uniform crop variety
(D) Frequent and systematic implementation of crop rotations

45. Consider the following statements concerning different classes of seed in India:
I. Nucleus seed is the initial handful of seed produced directly under the supervision of the plant breeder.
II. Breeder seed is the progeny of nucleus seed and is marked by a golden yellow tag.
III. Foundation seed is the progeny of breeder seed and carries a white tag.
IV. Certified seed is produced from foundation seed and is marked by an azure blue tag.
Which of the above statements is/are correct?
(A) I and IV only
(B) II and III only
(C) I, III and IV only
(D) I, II, III and IV

46. The concept of identifying the "Centres of Origin" for different crop plants based on the concentration of genetic diversity was first proposed by:
(A) Norman Borlaug
(B) M.S. Swaminathan
(C) N.I. Vavilov
(D) T.H. Morgan

47. Which of the following accurately describes a composite variety?
(A) A uniform single-cross hybrid developed by crossing two highly inbred lines
(B) Advanced open-pollinated progeny of intercrossed selected genotypes
(C) A multiline mixture composed of several phenotypically similar pure lines
(D) A genetically identical clonal population propagated solely by vegetative means

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48. What is the standard temperature for long-term conservation of crop germplasm using liquid nitrogen in a cryobank?
(A) 0 °C
(B) -20 °C
(C) -80 °C
(D) -196 °C

49. The process of plant breeding aimed at adapting a wild plant species to human management and cultivation over centuries is termed:
(A) Domestication
(B) Hybridization
(C) Introgression
(D) Acclimatization

multiply a cytoplasmic male sterile line (A-line).
III. Self-incompatibility cannot be utilized for hybrid seed production in any crop.
Which of the above statements is/are correct?
(A) I and II only
(B) II and III only
(C) I and III only
(D) I, II and III

31. What is the fundamental purpose of maintaining isolation distance during commercial seed production?
(A) To prevent nutrient competition between adjacent crop fields
(B) To prevent genetic contamination from stray cross-pollination
(C) To reduce the spread of soil-borne pathogens across field margins
(D) To ensure uniform availability and distribution of irrigation water

32. Removal of off-types and diseased plants from a seed production field before they can cross-pollinate or contaminate the crop is known as:
(A) Thinning
(B) Pruning
(C) Nipping
(D) Rogueing

33. Developing climate-resilient crop varieties primarily focuses on enhancing plant tolerance to which of the following?
(A) Abiotic stresses such as drought, heat, and salinity
(B) High application levels of synthetic chemical fertilizers
(C) Increased atmospheric levels of molecular oxygen gas
(D) Shorter day-lengths and photoperiod cycles exclusively

34. What is the central role of the Indian Council of Agricultural Research (ICAR) in the context of crop improvement in India?
(A) Enforcing and regulating the Minimum Support Price (MSP) across all states
(B) Managing commercial retail marketing and distribution of certified seeds
(C) Coordinating national agricultural research, education, and extension
(D) Regulating international trade tariffs and duties on agricultural goods

35. Match the research institute in List I with its location in List II:
List I: (Research Institute)
P. Indian Institute of Sugarcane Research (IISR)
Q. Sugarcane Breeding Institute (SBI)
R. UP Council of Sugarcane Research (UPCSR)
S. National Sugar Institute (NSI)
List II: (Location)
1. Shahjahanpur
2. Kanpur
3. Lucknow
4. Coimbatore
(A) P-3, Q-4, R-1, S-2
(B) P-3, Q-4, R-2, S-1
(C) P-4, Q-3, R-1, S-2
(D) P-1, Q-4, R-3, S-2

36. Which term describes the genetic masking effect where one gene suppresses the phenotypic expression of another non-allelic gene?
(A) Dominance
(B) Pleiotropy
(C) Incomplete dominance
(D) Epistasis

37. The process of synthesizing mRNA from a DNA template during the transfer of genetic information is called:
(A) Translation
(B) Transcription
(C) Replication
(D) Translocation

38. A test cross is performed in genetics to determine the genotype of an individual showing a dominant trait. It involves crossing the individual with:
(A) A homozygous dominant parent
(B) A heterozygous individual parent
(C) A homozygous recessive parent
(D) Any wild type individual parent

39. Which of the following mutagens is commonly used as a chemical agent for inducing point mutations in plant breeding?
(A) High-energy gamma radiation
(B) High-energy X-ray radiation
(C) Non-ionizing ultraviolet radiation
(D) Ethyl methane sulphonate (EMS)

40. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): Sugarcane is commercially

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CHAPTER 10
Genetics and Plant Breeding

1. Who among the following is widely recognized as the father of modern genetics for his foundational work on the inheritance of traits?
(A) Gregor Johann Mendel
(B) Charles Darwin
(C) Thomas Hunt Morgan
(D) Hugo de Vries

2. Which law of Mendel states that during the formation of gametes, the two alleles responsible for a trait separate from each other?
(A) Law of Dominance
(B) Law of Independent Assortment
(C) Law of Segregation
(D) Law of Linkage

3. The physical basis of heredity that carries genetic information in linear order is known as:
(A) Chromosome
(B) Ribosome
(C) Centrosome
(D) Lysosome

4. In the structure of DNA, which of the following nitrogenous bases pairs with Adenine?
(A) Guanine
(B) Cytosine
(C) Uracil
(D) Thymine

5. Consider the following statements regarding RNA:
I. It is generally single-stranded.
II. It contains the sugar deoxyribose.
III. Uracil is present in place of thymine.
Which of the above statements is/are correct?
(A) I and II only
(B) II and III only
(C) I and III only
(D) I, II and III

6. The basic principle of plant breeding involves the deliberate manipulation of plant species to create desired genotypes. Which of the following is the most primary step in any conventional plant breeding programme?
(A) Selection
(B) Evaluation
(C) Creation of variation
(D) Multiplication

7. What is the fundamental objective of plant breeding in agricultural crops?
(A) To extend the vegetative growth duration across diverse agro-climatic zones
(B) To strictly maintain primitive wild characteristics in traditional crop varieties
(C) To systematically reduce the genetic diversity of native agricultural landraces
(D) To significantly improve crop yield, quality, and stress tolerance mechanisms

8. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): Linkage reduces the frequency of genetic recombination.
Reason (R): Linked genes are located closely on the same chromosome and tend to be inherited together.
(A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
(B) Both Assertion (A) and Reason (R) are true but R is not the correct explanation of A.
(C) Assertion (A) is true but Reason (R) is false.
(D) Assertion (A) is false but Reason (R) is true.

9. The method of selection in which individual plants are selected on the basis of their phenotypic performance and their seeds are mixed together to grow the next generation is called:
(A) Pure line selection
(B) Mass selection
(C) Clonal selection
(D) Pedigree selection

10. Consider the following statements regarding the hybridization method:
I. It involves crossing two genetically different parents.
II. It is used to combine desirable traits from different lines into one.
III. Emasculation is completely unnecessary in

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50. Consider the following statements regarding the selection of sugarcane setts for planting:
I. Setts should be selected from healthy, 10 to 12-month-old crop.
II. The top one-third portion of the cane provides better quality seed due to higher moisture and glucose content.
III. Three-budded setts are generally preferred for commercial flat-bed planting in Uttar Pradesh.
Which of the above statements is/are correct?
(A) I and II only
(B) II and III only
(C) I and III only
(D) I, II and III

51. The phenomenon where a plant requires a specific length of day or night to initiate flowering (arrowing) is known as:
(A) Photoperiodism
(B) Vernalization
(C) Phototropism
(D) Thermoperiodism

52. Which of the following conditions is most crucial for inducing artificial flowering in sugarcane for hybridization purposes?
(A) Exposure to continuous complete darkness for thirty consecutive days
(B) Exposure to constant sub-zero freezing temperatures during the night
(C) Total and complete deprivation of soil moisture throughout growth
(D) Controlled daily photoperiods with exactly 12.5 hours of daylight

53. The genetic makeup of an organism is termed its genotype. What is the observable physical or biochemical characteristics of that organism called?
(A) Prototype
(B) Phenotype
(C) Biotype
(D) Ecotype

54. An essential mechanism to prevent self-pollination in hermaphrodite flowers where pollen is released before the stigma becomes receptive is called:
(A) Protogyny
(B) Cleistogamy
(C) Protandry
(D) Heterostyly

55. Match the term in List I with its definition in List II:
List I: (Term)
P. Mutation
Q. Crossing over
R. Polyploidy
S. Heterosis
List II: (Definition)
1. Exchange of genetic material between homologous chromosomes
2. Sudden inheritable change in the genetic material
3. Superiority of F1 hybrid over parents
4. Presence of more than two genomes in a cell
(A) P-1, Q-2, R-3, S-4
(B) P-2, Q-4, R-1, S-3
(C) P-3, Q-1, R-4, S-2
(D) P-2, Q-1, R-4, S-3

56. Which of the following groups of sugarcane varieties are developed specifically for early maturity and quick sugar accumulation in Uttar Pradesh?
(A) CoJ 64 and Co 0238
(B) Co 1148 and CoS 767
(C) Co 419 and Co 740
(D) Saccharum spontaneum clones

57. The "Gene-for-Gene" hypothesis, crucial for understanding plant-pathogen interactions in disease resistance breeding, was proposed by:
(A) J.E. Vanderplank
(B) H.H. Flor
(C) N.E. Borlaug
(D) G.H. Shull

58. Sharbati Sonora, an important wheat variety developed in India, is an example of success achieved through which breeding method?
(A) Pure line selection
(B) Mutation breeding
(C) Heterosis breeding
(D) Clonal selection

59. What is the fundamental difference between DNA and RNA regarding their sugar component?
(A) DNA contains deoxyribose, RNA contains ribose
(B) DNA contains ribose, RNA contains deoxyribose
(C) Both contain ribose, but DNA has extra oxygen
(D) Both contain deoxyribose, but RNA lacks oxygen

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(A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
(B) Both Assertion (A) and Reason (R) are true but R is not the correct explanation of A.
(C) Assertion (A) is true but Reason (R) is false.
(D) Assertion (A) is false but Reason (R) is true.

21. Which institute in India acts as the nodal agency for the collection, conservation, and management of plant genetic resources?
(A) Indian Agricultural Research Institute (IARI)
(B) National Bureau of Plant Genetic Resources (NBPGR)
(C) Indian Institute of Sugarcane Research (IISR)
(D) Council of Scientific and Industrial Research (CSIR)

22. Identify the correct sequence of steps involved in developing a new crop variety through conventional hybridization:
(A) Selection of pure lines → Selection of parents → Evaluation of segregating generations → Emasculation and crossing
(B) Evaluation of segregating generations → Selection of pure lines → Selection of parents → Emasculation and crossing
(C) Selection of parents → Emasculation and crossing → Evaluation of segregating generations → Selection of pure lines
(D) Selection of parents → Selection of pure lines → Emasculation and crossing → Evaluation of segregating generations

23. The true biological seed of sugarcane, obtained after hybridization, is technically referred to as:
(A) Sett
(B) Ratoon
(C) Slip
(D) Fluff or Fuzz

24. The Protection of Plant Varieties and Farmers' Rights (PPV&FR) Act was enacted in India in which year to establish an effective system for the protection of plant varieties?
(A) 1995
(B) 2001
(C) 2005
(D) 2010

25. Consider the following statements regarding the PPV&FR Act:
I. It protects the rights of plant breeders to stimulate investment in research.
II. It allows farmers to save, use, sow, and resow protected varieties.
III. It completely prohibits farmers from selling unbranded seed of a protected variety.
IV. It facilitates the growth of the seed industry in the country.
Which of the above statements is/are correct?
(A) I, II and IV only
(B) I, III and IV only
(C) II, III and IV only
(D) I, II, III and IV

26. Which scientific breakthrough is historically associated with Dr. C.A. Barber and Sir T.S. Venkatraman at the Sugarcane Breeding Institute, Coimbatore?
(A) Development of Bt Sugarcane
(B) Nobelization of Indian canes
(C) Sequencing of the sugarcane genome
(D) Discovery of sugarcane red rot

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27. What does the prefix "Co" stand for in the naming convention of prominent sugarcane varieties like Co 0238?
(A) Coimbatore
(B) Commercial
(C) Cooperative
(D) Composite

28. Which sugarcane species is widely known as the "Noble cane" due to its high sucrose content, thick stalks, and low fibre?
(A) Saccharum spontaneum
(B) Saccharum barberi
(C) Saccharum officinarum
(D) Saccharum sinense

29. The process of evaluating and approving a newly developed crop variety at the state or national level before its commercial cultivation is overseen by the:
(A) Food Corporation of India (FCI)
(B) Indian Council of Agricultural Research (ICAR) Governing Body
(C) State Seed Testing Laboratory
(D) Central Sub-Committee on Crop Standards, Notification and Release of Varieties

30. Consider the following statements about hybrid seed production:
I. Male sterility systems are widely used to eliminate the need for manual emasculation.
II. A maintainer line (B-line) is required to

standard room conditions
(C) Moderately long, retaining high viability for at least 10 years
(D) Very short, typically losing viability within a few weeks

72. Which of the following denotes an individual having different alleles at a particular locus?
(A) Heterozygous genotype
(B) Homozygous genotype
(C) Hemizygous condition
(D) Nullizygous genotype

73. What is the significance of utilizing the "National Hybridization Garden" situated at Coimbatore?
(A) To conduct large-scale commercial flat bed planting and yield evaluation trials
(B) To facilitate controlled crossing under favorable flowering conditions
(C) To produce refined commercial sugar directly from experimental sugarcane crops
(D) To field test and calibrate heavy agricultural machinery for sugarcane farming

74. Which of the following naming codes is specifically assigned to sugarcane varieties developed jointly by the Sugarcane Breeding Institute and the research station in Shahjahanpur, Uttar Pradesh?
(A) Co
(B) CoS
(C) CoJ
(D) CoLk

75. Match the major sugarcane disease in List I with its causal organism in List II:
List I: (Disease)
P. Red Rot
Q. Smut
R. Wilt
S. Grassy Shoot
List II: (Causal Organism)
1. Phytoplasma
2. Sporisorium scitamineum
3. Colletotrichum falcatum
4. Fusarium sacchari
(A) P-3, Q-2, R-4, S-1
(B) P-3, Q-4, R-2, S-1
(C) P-2, Q-3, R-1, S-4
(D) P-1, Q-2, R-3, S-4

76. In an agricultural context, which breeding objective specifically targets extending the shelf life and enhancing the nutritional value of a crop?
(A) Yield improvement
(B) Disease resistance
(C) Quality improvement
(D) Weed competitiveness

77. The process of fusion of protoplasts from two different plant species to create somatic hybrids is a tool used in:
(A) Conventional sexual hybridization techniques
(B) Methodical pure line crop selection
(C) Phenotypic mass selection procedures
(D) Plant tissue culture and biotechnology

78. A genetically modified crop containing genes transferred from completely unrelated species (like bacteria) is properly termed as:
(A) Inbred crop variety
(B) Mutated crop variety
(C) Transgenic crop
(D) Polyploid crop variety

79. The basic structure of chromosomes is primarily composed of:
(A) Structural RNA and membrane lipids
(B) Nuclear DNA and histone proteins
(C) Complex carbohydrates and messenger RNA
(D) Structural lipids and functional proteins

80. In conventional sugarcane breeding, what is the most significant constraint for breeders operating in subtropical areas like Uttar Pradesh?
(A) Excessive sugar accumulation in stalks hindering natural seed formation
(B) Complete non-availability of fertile soils suitable for crop growth
(C) Widespread unavailability of vegetative setts for crop establishment
(D) Lack of natural flowering and viable seed set due to non-conducive climate

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60. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): Clonal selection is highly effective in improving self-pollinated crops like wheat and paddy.
Reason (R): Clones are vegetatively propagated progenies derived from a single plant.
(A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
(B) Both Assertion (A) and Reason (R) are true but R is not the correct explanation of A.
(C) Assertion (A) is false but Reason (R) is true.
(D) Both Assertion (A) and Reason (R) are false.

61. The technique of in vitro multiplication of plants under aseptic conditions, increasingly used for producing disease-free sugarcane setts, is known as:
(A) In vitro somatic embryogenesis process
(B) Induced chemical mutation breeding
(C) Commercial hybrid seed production
(D) Plant tissue culture micropropagation

62. Which class of seeds requires the highest genetic purity requirement of nearly 100%?
(A) Certified seed
(B) Foundation seed
(C) Nucleus seed
(D) Truthfully labelled seed

63. "Ideotype breeding" refers to a method where breeding is aimed at:
(A) Developing crop varieties purely through random mass selection methods
(B) Designing an ideal plant phenotype for a target environment
(C) Selecting individual plants strictly on the basis of taste and flavor
(D) Selecting exclusively from uncultivated wild plant species

64. The loss of vigour, yield, and fitness resulting from the continuous mating of closely related individuals in cross-pollinated crops is termed:
(A) Heterosis or hybrid vigour
(B) Chromosomal polyploidy
(C) Random cross-outcrossing
(D) Inbreeding depression

65. Arrange the following stages of the seed multiplication chain in the correct sequential order from initial development to commercial distribution:
I. Foundation Seed
II. Certified Seed
III. Nucleus Seed
IV. Breeder Seed
(A) I, II, III, IV
(B) III, IV, I, II
(C) IV, III, I, II
(D) III, I, IV, II

66. In plant breeding, a line produced by continuous self-pollination that is highly homozygous is known as a/an:
(A) Hybrid line
(B) Synthetic line
(C) Inbred line
(D) Composite line

67. The phenomenon by which identical genotypes display different phenotypes when grown in varied environmental conditions is called:
(A) Genotype-environment interaction
(B) Non-allelic epistatic gene interaction
(C) Chromosomal genetic linkage mechanism
(D) Spontaneous nuclear gene mutation

68. Which of the following provides the raw material necessary for any plant breeding programme?
(A) Synthetic chemical fertilizers
(B) Modern agricultural machinery
(C) Chemical weed herbicides
(D) Genetic variation (Germplasm)

69. Marker-Assisted Selection (MAS) uses which type of markers to select desired traits indirectly in plant breeding?
(A) Morphological markers only
(B) DNA (Molecular) markers
(C) Biochemical markers only
(D) Yield parameters only

70. When the entire genome of a species is multiplied, resulting in individuals with three or more sets of chromosomes (e.g., 3x, 4x), it is called:
(A) Numerical aneuploidy
(B) Gametic haploidy
(C) Euploidy (Polyploidy)
(D) Normal diploidy

71. The viability of sugarcane fuzz (true seed) under normal atmospheric conditions is typically:
(A) Highly persistent, remaining viable for up to 5 full years
(B) Virtually indefinite when kept under

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improve population traits without conducting individual progeny testing.

10. (B) III only
Hybridization crosses genetically distinct parents to combine target traits and generate variation in segregating offspring. In self-pollinated plants, emasculation—the physical removal of immature anthers from female parents—is essential to prevent unwanted self-fertilization prior to controlled cross-pollination. Therefore, the assertion claiming that emasculation is unnecessary in self-pollinated crops during hybridization is completely incorrect.

11. (A) Clonal selection
Clonal selection is the standard breeding strategy applied to vegetatively propagated crops such as sugarcane, potato, and banana. Superior individual plants selected from a mixed population are preserved and multiplied through vegetative structures, ensuring that the specific combination of desirable genes and heterosis is maintained completely intact across future asexual generations.

12. (C) P-3, Q-1, R-4, S-2
Pure line selection isolates homogeneous lines from self-pollinated populations to produce uniform varieties. The backcross method repeatedly crosses hybrids with a recipient parent to transfer a single gene, such as disease resistance. Heterosis breeding exploits hybrid vigour for superior yield, while mutation breeding induces novel genetic variation using radiation like gamma rays.

13. (B) F2 generation
In the pedigree method of plant breeding, individual plant selection begins in the second filial generation, where maximum genetic segregation occurs following the uniform first filial generation. Breeders evaluate and select superior individual plants based on visual phenotypic traits, meticulously tracking detailed ancestry records of each selection through subsequent segregating generations until homozygosity is reached.

14. (C) To prevent self-pollination
Emasculation is the practice of removing immature, pollen-bearing anthers from bisexually functional flowers before dehiscence occurs. The primary goal is to prevent self-pollination within female parents, thereby ensuring that seed development occurs strictly through controlled cross-pollination with chosen pollen sources during hybrid development and artificial plant crossing programs in agricultural research.

15. (A) I and II only
Polyploid plants contain three or more complete sets of chromosomes, and colchicine is widely employed to double chromosome numbers by disrupting spindle fiber formation during cell division. Triploid organisms, such as triploid watermelons, suffer from meiotic irregularities leading to seedlessness and sterility rather than full fertility, making only the first two statements accurate.

16. (D) Heterosis
Heterosis, or hybrid vigour, describes the phenomenon where crossbred offspring exhibit enhanced growth, biomass, yield, or resilience compared to both inbred parental lines. Resulting from non-additive gene action and masked recessive deleterious alleles, heterosis is broadly exploited across commercial plant breeding to develop high-yielding hybrid cultivars in major agricultural food crops.

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17. (A) Increased homozygosity
Repeated self-pollination over successive generations reduces genetic heterozygosity by fifty percent in each generation. This continuous selfing leads toward high genetic uniformity and near-complete homozygosity across loci. In naturally self-pollinated crops, this process naturally forms stable, true-breeding pure lines without causing severe inbreeding depression or complete plant sterility in normal field conditions.

18. (C) Backcross method
The backcross method is designed to transfer a specific desirable trait, such as single-gene disease resistance, from a donor parent into an established elite recurrent parent. Repeated crossing with the recurrent parent accompanied by selection recovers the entire recipient genome while retaining only the target resistance gene, preserving elite agronomic qualities.

19. (A) Vertical resistance
Vertical resistance, also called race-specific or qualitative resistance, is controlled by one or a few major genes providing complete

interactions governing gene-for-gene plant disease resistance systems.

58. (B) Mutation breeding
Sharbati Sonora is a famous mutant wheat variety developed in India by treating the Mexican wheat cultivar Sonora 64 with gamma radiation. This physical mutagenesis modified kernel color from red to amber and enhanced protein content, demonstrating the utility of mutation breeding in improving specific economic traits in established semi-dwarf wheat genotypes.

59. (A) DNA contains deoxyribose, RNA contains ribose
The essential chemical difference in the pentose sugar component between DNA and RNA lies in the presence or absence of a hydroxyl group at the C-2' position. Deoxyribonucleic acid contains 2-deoxyribose sugar lacking an oxygen atom at position C-2', whereas ribonucleic acid contains fully hydroxylated ribose sugar in its sugar-phosphate backbone.

60. (C) Assertion (A) is false but Reason (R) is true.
Clones are defined as asexual, genetically identical progenies derived from a single vegetative plant. However, clonal selection is applicable only to vegetatively propagated crops like sugarcane or potato. Naturally self-pollinated seed-propagated crops like wheat and paddy are improved through pure line or pedigree selection methods, making the assertion false while the reason remains true.

61. (D) Plant tissue culture micropropagation
Micropropagation via plant tissue culture involves in vitro culture of excised explants like meristems or shoot tips under sterile nutrient conditions. This biotechnological method enables rapid vegetative multiplication of disease-free plantlets, notably eliminating viral pathogens in sugarcane seed stocks to produce clean, high-yielding planting material for commercial distribution to sugarcane growers.

62. (C) Nucleus seed
Nucleus seed represents the initial handful of seed produced directly under the complete supervision of the originating plant breeder. Possessing 100% physical and genetic purity without any off-types, nucleus seed serves as the foundation stock from which breeder seed is produced, establishing the highest purity standard within the official seed multiplication chain.

63. (B) Designing an ideal plant phenotype for a target environment
Ideotype breeding, introduced by Donald, is a systematic selection approach focused on conceptualizing and designing an idealized plant architecture optimized for maximum photosynthetic efficiency and yield in a specific target environment. Breeders combine specific morphological and physiological traits, such as erect leaves and short stems, to optimize resource capture and crop productivity.

64. (D) Inbreeding depression
Inbreeding depression refers to the loss of vigor, biomass, fertility, and economic yield resulting from continuous self-fertilization or close endogamous mating within cross-pollinated species. This physiological decline is caused by increasing homozygosity, which exposes deleterious recessive alleles that were previously masked in heterozygous states, resulting in reduced overall biological fitness.

65. (B) III, IV, I, II
The official seed multiplication chain follows a strict hierarchical progression to maintain genetic purity across seed generations. The process initiates with Nucleus Seed, which is multiplied to produce Breeder Seed under breeder supervision. Breeder seed is then multiplied to form Foundation Seed, which is ultimately grown to yield Certified Seed for farming.

66. (C) Inbred line
An inbred line is a near-fully homozygous genotype developed through continuous self-pollination over multiple successive generations, usually six to eight generations. Highly uniform and true-breeding, inbred lines serve as essential parental components in hybrid seed production, where crossing two distinct inbred lines produces uniform F1 hybrids exhibiting high commercial heterosis.

67. (A) Genotype-environment interaction
Genotype-environment interaction describes the differential phenotypic performance of identical genotypes when grown across varied environmental conditions. This environmental interaction causes variations in relative crop ranking, yield performance, and trait expression across locations and seasons, necessitating multi-environment testing to identify broadly adapted

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29. (D) Central Sub-Committee on Crop Standards, Notification and Release of Varieties
The formal evaluation, official release, and commercial notification of newly developed crop varieties across India are governed by the Central Sub-Committee on Crop Standards, Notification and Release of Varieties. Operating under the Seeds Act, this statutory body reviews multi-location performance trial data before approving varieties for certified seed production and distribution.

30. (A) I and II only
Male sterility systems eliminate manual emasculation during commercial hybrid seed production. A maintainer B-line carries normal cytoplasm and restores no fertility, allowing the asexual multiplication of cytoplasmic male sterile A-lines. Because self-incompatibility is also successfully utilized in crops like Brassica for hybrid seed, the statement claiming it cannot be utilized is incorrect.

31. (B) To prevent genetic contamination from stray cross-pollination
Maintaining a specified physical isolation distance between seed production plots and adjacent commercial crop fields is critical for preserving genetic purity. Distance barriers prevent unwanted gene flow caused by wind-borne or insect-mediated stray pollen from foreign varieties, ensuring that harvested seeds maintain complete trueness-to-type without genetic contamination across seed generations.

32. (D) Rogueing
Rogueing refers to the systematic physical removal of off-types, diseased plants, weeds, or unwanted cultivars from seed multiplication fields. Conducted at various crop growth stages before flowering and anthesis, rogueing prevents cross-pollination with unwanted plants, maintaining strict genetic and physical purity standards required for official certified seed production in agriculture.

33. (A) Abiotic stresses such as drought, heat, and salinity
Breeding modern climate-resilient crop varieties aims to equip plants with structural and physiological features that withstand extreme abiotic stresses. Enhancing tolerance to environmental challenges like prolonged drought, high ambient heat, extreme cold, and soil salinity ensures stable agricultural yields and minimizes food production risks under shifting global environmental climatic conditions.

34. (C) Coordinating national agricultural research, education, and extension
The Indian Council of Agricultural Research functions as an autonomous organization responsible for guiding, managing, and coordinating agricultural research and education across India. Under the Department of Agricultural Research and Education, it oversees a vast national network of institutes, national bureaus, and state agricultural universities to advance technology-driven crop improvement.

35. (A) P-3, Q-4, R-1, S-2
The Indian Institute of Sugarcane Research is headquartered in Lucknow, while the primary Sugarcane Breeding Institute is located in Coimbatore. The Uttar Pradesh Council of Sugarcane Research carries out specialized sugarcane research in Shahjahanpur, and the National Sugar Institute operates from Kanpur, establishing prominent research centers across major agricultural sugar producing regions of India.

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36. (D) Epistasis
Epistasis represents a form of non-allelic gene interaction in which one gene masks or modifies the physical expression of a second, independent gene at a distinct locus. Unlike classic dominance between alleles of the same gene, epistasis operates between different loci, producing modified Mendelian phenotypic ratios in segregating cross populations.

37. (B) Transcription
Transcription is the biological process in which messenger RNA is synthesized using a complementary DNA strand as a template. Catalyzed by RNA polymerase, transcription transfers genetic instructions stored in double-stranded genomic DNA into single-stranded RNA molecules, which subsequently carry genetic information to ribosomes to direct protein synthesis during cellular translation.

38. (C) A homozygous recessive parent
A test cross involves mating an individual displaying a dominant phenotype with a tester parent known to be homozygous recessive for the target trait. By evaluating the phenotypic ratio of

the resulting progeny, geneticists can determine whether the dominant individual is homozygous dominant or heterozygous, as recessive parents contribute only recessive alleles.

39. (D) Ethyl methane sulphonate (EMS)
Ethyl methane sulphonate is an alkylating chemical mutagen widely utilized in induced mutation breeding to generate point mutations in plant genomes. By reacting with guanine bases, EMS induces nucleotide transitions, primarily G:C to A:T substitution mutations, producing high mutation frequencies in plant seeds and tissues without causing major structural chromosomal breakage.

40. (A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
Sugarcane varieties are highly heterozygous polyploids; propagating them via sexual seed leads to extreme segregation and loss of parental character combinations. Consequently, sugarcane is commercially propagated using vegetative stem cuttings called setts. Vegetative propagation preserves the exact parental genotype, clone identity, and high-yielding traits across multiple successive commercial crop cycles.

41. (B) Saccharum spontaneum
Saccharum spontaneum is a wild, fibrous, low-sugar sugarcane relative recognized for its extreme hardiness, vigorous root growth, and outstanding resistance to pests, diseases, and abiotic environmental stresses. Incorporating this wild species in crossbreeding programs provided essential resistance genes to modern sugarcane hybrids, laying the foundation for disease-resistant cultivars developed worldwide.

42. (B) Germplasm screening → Crossing with susceptible high-yielder → Selection in segregating generations → Yield trials
Developing a disease-resistant crop variety begins with screening germplasm to identify reliable sources of resistance. Identified resistant parents are crossed with high-yielding susceptible varieties to combine resistance and productivity. Selection is performed across segregating generations to isolate stable resistant progeny, which are subsequently subjected to yield evaluation trials before release.

43. (A) Locus
In genetics, a locus refers to the precise, specific physical location or position occupied by a gene or marker along the linear structure of a chromosome. Alleles representing alternative nucleotide sequence variants of a gene reside at corresponding loci on homologous chromosomes, governing specific hereditary traits in a living organism.

44. (C) Monoculture of a single genetically uniform crop variety
Genetic vulnerability arises when large agricultural areas are planted with a single genetically uniform crop variety in continuous monoculture. Lacking genetic diversity, such uniform crop populations are highly susceptible to sudden, widespread epidemics caused by newly emerging pathogen races or pests, historically illustrated by severe disease outbreaks like the Irish Potato Famine.

45. (D) I, II, III and IV
The Indian seed multiplication system comprises four recognized seed classes. Nucleus seed is directly produced by plant breeders with maximum genetic purity. Breeder seed derives from nucleus seed and carries a golden yellow tag. Foundation seed is produced from breeder seed under white tags, while certified seed carries an azure blue tag.

46. (C) N.I. Vavilov
Nikolai Ivanovich Vavilov introduced the concept of primary and secondary centers of origin for cultivated plants based on geographical concentrations of genetic diversity. Through extensive global scientific expeditions, Vavilov identified eight primary global regions where crop species originated and domesticated, establishing fundamental principles for genetic resource collection and germplasm conservation.

47. (B) Advanced open-pollinated progeny of intercrossed selected genotypes
A composite variety is developed by intercrossing a group of phenotypically superior, open-pollinated genotypes possessing good general combining ability. Unlike synthetic varieties, composite varieties are advanced in subsequent generations through open pollination without maintaining original parental lines, resulting in a heterogeneous yet phenotypically uniform

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population suited for commercial crop production.

48. (D) -196 °C
Cryopreservation involves storing ultra-clean biological plant tissues, seeds, or pollen at an ultra-low temperature of minus 196 degrees Celsius in liquid nitrogen. At this temperature, metabolic activities and cellular divisions cease completely, preserving plant genetic material indefinitely without genetic alteration, rendering it ideal for long-term germplasm banking in gene banks.

49. (A) Domestication
Domestication is the historical process of bringing wild plant species under human cultivation and management. Over long periods, continuous human selection transforms wild plants by altering traits like seed shattering, dormancy, toxicity, and growth habits into domesticated crops possessing favorable agronomic characteristics adapted to agricultural cultivation and direct human consumption.

50. (D) I, II and III
Selecting quality sugarcane setts requires taking planting material from healthy, 10 to 12-month-old nursery crops. The top one-third stem portion provides higher germination rates due to elevated moisture content and reducing sugars like glucose. Three-budded setts are standard for flat-bed planting in Uttar Pradesh, making all three stated conditions correct.

51. (A) Photoperiodism
Photoperiodism represents the physiological response of plants to the relative duration of light and dark periods, which regulates crucial developmental transitions such as flowering. In sugarcane, arrowing is triggered by precise photoperiodic signals, requiring specific critical day lengths to induce floral primordia initiation and transition from vegetative to reproductive phases.

52. (D) Controlled daily photoperiods with exactly 12.5 hours of daylight
Artificial induction of flowering in sugarcane for hybridization requires precise environmental control in specialized photoperiod houses. Exposing sugarcane plants to an exact daily photoperiod of 12.5 hours of daylight coupled with high relative humidity and warm temperatures successfully initiates floral induction, enabling synchronized flowering between distinct parental sugarcane clone lines.

53. (B) Phenotype
Phenotype denotes the observable physical, structural, physiological, and biochemical traits exhibited by an organism. It results from the interaction between the individual's genetic constitution, known as its genotype, and environmental factors operating during growth. Examples of phenotypic traits in crops include plant height, kernel color, tillering habit, and disease resistance.

54. (C) Protandry
Protandry is a dichogamous floral adaptation where anthers mature and shed pollen before the stigma of the same flower becomes receptive. By preventing overlapping temporal maturity between male and female reproductive organs within bisexual flowers, protandry discourages self-fertilization and promotes cross-pollination across individuals, maintaining genetic diversity in natural plant populations.

55. (D) P-2, Q-1, R-4, S-3
Mutation is defined as a sudden heritable change in genetic material. Crossing over represents the physical exchange of non-sister chromatid genetic material between homologous chromosomes during meiosis. Polyploidy refers to the presence of more than two complete chromosomal genomes, and heterosis denotes the superior performance of F1 hybrids over parents.

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56. (A) CoJ 64 and Co 0238
CoJ 64 and Co 0238 are landmark early-maturing sugarcane varieties introduced to enhance early sugar recovery in Uttar Pradesh sugar mills. These cultivars accumulate high sucrose early in the crushing season while maintaining superior stalk yield, enabling sugar factories to commence crushing operations early with high sugar extraction efficiency across subtropical regions.

57. (B) H.H. Flor
The Gene-for-Gene hypothesis was established by Harold Henry Flor through his study of flax rust caused by Melampsora lini. Flor demonstrated that for every resistance gene in the host plant, there is a corresponding avirulence gene in the pathogen, defining specific molecular recognition

from two distinct plant species and fusing them using polyethylene glycol or electric fields. Used within plant tissue culture and biotechnology, this technique bypasses sexual incompatibility barriers, enabling the combination of nuclear and cytoplasmic genomes from distantly related target plant species.

78. (C) Transgenic crop
A transgenic crop is a genetically engineered plant whose genome incorporates foreign DNA sequences transferred from unrelated species using recombinant DNA technology. By inserting specific foreign genes—such as insect-resistance genes from Bacillus thuringiensis—transgenic crops express novel traits that cannot be introduced through conventional sexual hybridization between sexually compatible plant species.

79. (B) Nuclear DNA and histone proteins
Chromosomes are complex biological structures located inside the nucleus composed primarily of genomic double-stranded DNA wrapped tightly around basic histone proteins. This DNA-histone arrangement forms repeating structural units called nucleosomes, which condense into chromatin fibers, ensuring structural stabilization, efficient spatial packaging, and regulated gene expression within eukaryotic plant cells.

80. (D) Lack of natural flowering and viable seed set due to non-conducive climate
The main constraint in conventional subtropical sugarcane breeding is the lack of natural flowering and viable seed production under prevailing climatic conditions. Low temperatures and unfavorable photoperiods in regions like Uttar Pradesh inhibit floral transition, requiring true seeds or fluff to be synthesized in tropical locations like Coimbatore for subtropical selection.

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or specific-environment targeted crop varieties in agricultural breeding programs.

68. (D) Genetic variation (Germplasm)
Genetic variation, preserved as crop germplasm, provides the indispensable raw material for any modern plant breeding program. Genetic diversity across wild relatives, landraces, and cultivated lines supplies alleles for yield, quality, and stress resistance. Without sufficient genetic variation, artificial selection cannot operate, preventing progress in developing superior improved crop cultivars.

69. (B) DNA (Molecular) markers
Marker-Assisted Selection utilizes DNA markers linked to specific target genes to select desirable traits indirectly at early plant growth stages. Because DNA markers are environment-independent and non-destructive, MAS increases selection efficiency, accelerates breeding cycles, and enables precise pyramiding of multiple resistance genes without relying solely on variable visual phenotypic traits.

70. (C) Euploidy (Polyploidy)
Euploidy, specifically polyploidy, describes a chromosomal state where an organism possesses three or more complete somatic sets of chromosomes, such as triploid or tetraploid complements. Polyploidy plays a major role in plant evolution and crop breeding, frequently inducing cell enlargement, increased organ size, and enhanced environmental adaptability in cultivated plant species.

71. (D) Very short, typically losing viability within a few weeks
Sugarcane fuzz, representing true botanical seed, exhibits extremely short viability under natural ambient environmental conditions. Lacking thick protective coats and long-term desiccation tolerance, fuzz rapidly loses seed germinability within a few weeks of maturity unless stored immediately under specialized moisture-controlled, low-temperature cold storage conditions to maintain viability for future breeding trials.

72. (A) Heterozygous genotype
A heterozygous genotype describes an individual that possesses two distinct, different alleles at a specific genomic locus on homologous chromosomes. Inheriting one dominant allele and one alternative recessive allele results in a heterozygous condition, where the dominant allele typically determines the physical phenotype while masking the recessive allele's biological expression.

73. (B) To facilitate controlled crossing under favorable flowering conditions
The National Hybridization Garden in Coimbatore provides ideal tropical photoperiodic and climatic conditions that naturally stimulate abundant flowering across diverse sugarcane parental lines. Establishing this specialized national facility allows breeders nationwide to assemble elite sugarcane clones, synchronizing blooming schedules to execute controlled artificial cross-pollination and fluff seed production quite efficiently.

74. (B) CoS
The prefix "CoS" denotes sugarcane cultivars developed collaboratively between the Sugarcane Breeding Institute in Coimbatore and the UP Council of Sugarcane Research station in Shahjahanpur. Initial hybrid fuzz produced in Coimbatore is selected, evaluated, and adapted specifically for subtropical growing conditions at Shahjahanpur, resulting in regional varieties named under the CoS designation.

75. (A) P-3, Q-2, R-4, S-1
Red rot in sugarcane is caused by the fungal pathogen Colletotrichum falcatum, while sugarcane smut is caused by Sporisorium scitamineum. Sugarcane wilt is incited by Fusarium sacchari, and grassy shoot disease is caused by wall-less phytoplasma vectors, matching each major sugarcane disease with its precise causal pathogen organism in plants.

76. (C) Quality improvement
Quality improvement breeding focuses on enhancing technological, nutritional, and post-harvest storage properties of crop produce. Objectives include increasing sugar recovery in sugarcane, protein or vitamin content in grains, oil quality in oilseeds, and shelf-life in fruits and vegetables, ensuring harvested agricultural products satisfy processing standards and direct consumer market requirements.

77. (D) Plant tissue culture and biotechnology
Protoplast fusion, or somatic hybridization, involves isolating cell-wall-stripped protoplasts

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protection against specific pathogen races. However, because it operates on a gene-for-gene mechanism, it is easily broken down when new virulent physiological strains of the pathogen evolve, leading to sudden loss of effectiveness.

20. (A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
Sugarcane breeding activities in India are concentrated in tropical regions like Coimbatore because the warm, humid climate and ideal photoperiods facilitate natural flowering, viable pollen production, and seed setting. Subtropical areas like Uttar Pradesh lack these favorable conditions, necessitating breeding in Coimbatore to produce fluff for subsequent variety development across regions.

21. (B) National Bureau of Plant Genetic Resources (NBPGR)
The National Bureau of Plant Genetic Resources, located in New Delhi, serves as the premier Indian institution responsible for managing plant genetic resources. It coordinates national activities involving the collection, conservation, exchange, evaluation, and documentation of indigenous and introduced crop germplasm, maintaining long-term seed storage facilities in national gene banks for future breeding.

22. (C) Selection of parents → Emasculation and crossing → Evaluation of segregating generations → Selection of pure lines
Developing crop cultivars via conventional hybridization follows a structured sequential pipeline. Breeders start by selecting suitable parental lines with complementary desirable traits, followed by emasculation and artificial crossing to generate F1 hybrids. The resulting segregating generations undergo rigorous field evaluation and selection until stable, homozygous pure lines are isolated for multi-location performance evaluation.

23. (D) Fluff or Fuzz
The biological botanical seed produced within the inflorescence arrow of sugarcane after successful pollination is commonly termed fluff or fuzz. Unlike vegetative setts used in commercial farming, fluff represents sexually produced seed containing genetic segregation, which plant breeders germinate in nursery trays to generate variable seedling populations for early-stage clone selection.

24. (B) 2001
The Protection of Plant Varieties and Farmers' Rights Act was enacted by the Parliament of India in 2001. This landmark legislation created a legal framework to protect the intellectual property rights of plant breeders while simultaneously safeguarding traditional rights of farmers to save, use, exchange, or sell farm-saved seed of protected varieties.

25. (A) I, II and IV only
The PPV&FR Act balances plant breeder rights with agricultural freedoms. It provides intellectual protection to stimulate private and public investment in breeding while allowing farmers to save, sow, and exchange seed. Farmers may sell unbranded produce and seed of protected varieties, making claims of total sales prohibition false, while promoting overall seed industry growth.

26. (B) Nobelization of Indian canes
The process of "nobelization" involved hybridization between thin, hardy Indian canes (Saccharum barberi) and high-yielding, thick "noble" canes (Saccharum officinarum), along with wild species (Saccharum spontaneum). Pioneered by Dr. C.A. Barber and Sir T.S. Venkatraman at SBI Coimbatore, this program created resilient, high-sucrose hybrid sugarcane cultivars adapted to subtropical Indian environments.

27. (A) Coimbatore
In sugarcane variety designation, the prefix "Co" denotes cultivars bred or bred-and-selected at the Sugarcane Breeding Institute located in Coimbatore, Tamil Nadu. Standardized selection codes identify the station of origin, where "Co" represents Coimbatore, providing a universal system for tracking breeding history and pedigree backgrounds across national sugarcane research centers.

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28. (C) Saccharum officinarum
Saccharum officinarum is universally referred to as the "noble cane" due to its thick stalks, high sucrose concentration, low fiber content, and juicy pith. Native to New Guinea, this species provided the primary genetic source for high sugar yield during early breeding attempts, though its susceptibility to diseases required crossing with wild species for hardiness.

CHAPTER 11
Crop Physiology

1. The physiological process by which green plants synthesize their own food using solar energy, carbon dioxide, and water is known as photosynthesis. Where does the light-dependent reaction of this process primarily take place?
(A) Stroma of the chloroplast
(B) Grana of the chloroplast
(C) Matrix of the mitochondria
(D) Cytoplasm of the mesophyll cells

2. During the dark reaction of photosynthesis in C3 plants, what is the first stable chemical compound formed after carbon dioxide fixation?
(A) Oxaloacetic acid (OAA)
(B) Ribulose bisphosphate (RuBP)
(C) Malic acid
(D) Phosphoglyceric acid (PGA)

3. In the process of photosynthesis, oxygen is released as a byproduct. What is the source of this evolved oxygen?
(A) Photolysis of water
(B) Reduction of carbon dioxide
(C) Breakdown of glucose
(D) Photorespiration in peroxisomes

4. Sugarcane is a highly efficient agricultural crop. Under which photosynthetic pathway is sugarcane classified, and what is its first stable product?
(A) C3 pathway, Phosphoglyceric acid
(B) CAM pathway, Malic acid
(C) C4 pathway, Oxaloacetic acid
(D) C4 pathway, Ribulose bisphosphate

5. The leaves of C4 plants, such as sugarcane and maize, possess a specialized internal anatomy that prevents photorespiration. What is this anatomical structure called?
(A) Kranz anatomy
(B) Spongy anatomy
(C) Palisade anatomy
(D) Bulliform anatomy

6. Match List I with List II and select the correct option:
List I: Photosynthetic Pathway
P. C3 Plant
Q. C4 Plant
R. CAM Plant
S. Submerged Hydrophyte
List II: Example Crop
1. Sugarcane
2. Hydrilla
3. Pineapple
4. Wheat
(A) P-1, Q-4, R-2, S-3
(B) P-4, Q-3, R-1, S-2
(C) P-3, Q-1, R-4, S-2
(D) P-4, Q-1, R-3, S-2

7. C4 plants generally produce a higher dry matter yield per unit of water transpired compared to C3 plants. What is the primary physiological reason for this higher efficiency?
(A) Complete absence of cellular dark respiration
(B) Negligible or minimal photorespiration
(C) Complete absence of leaf epidermal stomata
(D) Lower physiological requirement of solar light

8. The rate of photosynthesis is influenced by varying light intensities. Which of the following statements is true regarding the light saturation point of crops like sugarcane?
(A) They reach light saturation under extremely low light intensity levels.
(B) Their light saturation point is significantly lower than that of wheat.
(C) They do not reach light saturation even under full sunlight.
(D) They require artificial shading conditions for optimal photosynthesis.

9. Read the given assertion and reason, and select the correct option:
Assertion (A): Sugarcane plants can continue carbon dioxide fixation even when the internal CO_2 concentration is very low.
Reason (R): The enzyme PEP carboxylase present in the mesophyll cells of C4 plants has a very high affinity for carbon dioxide.
(A) Both Assertion (A) and Reason (R) are true

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and R is the correct explanation of A.
(B) Both Assertion (A) and Reason (R) are true but R is not the correct explanation of A.
(C) Assertion (A) is true but Reason (R) is false.
(D) Assertion (A) is false but Reason (R) is true.

10. Temperature significantly affects the physiological functions of a plant. What is the generally accepted optimum temperature range for maximum photosynthetic rate in tropical C4 crops like sugarcane?
(A) 15 to 20 degree Celsius
(B) 20 to 25 degree Celsius
(C) 30 to 35 degree Celsius
(D) 40 to 45 degree Celsius

11. Respiration is a vital catabolic process for energy production. In which part of the plant cell does the glycolysis phase of respiration occur?
(A) Inner mitochondrial membrane
(B) Cytoplasm
(C) Chloroplast stroma
(D) Nucleoplasm

12. Under aerobic respiration, the complete oxidation of one molecule of glucose generates a net yield of approximately how many ATP molecules?
(A) 2 ATP
(B) 12 ATP
(C) 24 ATP
(D) 38 ATP

13. The Respiratory Quotient (RQ) is the ratio of the volume of CO_2 evolved to the volume of O_2 consumed. What is the RQ value when pure carbohydrates (like sucrose in sugarcane) are used as the respiratory substrate?
(A) 0.7
(B) 0.9
(C) 1.0
(D) More than 1.0

14. Anaerobic respiration occurs in the absence of molecular oxygen. What are the common end products of anaerobic respiration in waterlogged plant roots?
(A) Lactic acid, water, and thermal energy
(B) Pyruvic acid and molecular oxygen gas
(C) Ethyl alcohol and carbon dioxide
(D) Citric acid, water, and molecular oxygen

15. Consider the following statements regarding anaerobic respiration in plants:
I. It takes place entirely within the cytoplasm of the cell.
II. It yields significantly more energy (ATP) per glucose molecule than aerobic respiration.
III. It involves the incomplete breakdown of the respiratory substrate.
Which of the above statement(s) is/are correct?
(A) I and II
(B) II and III
(C) I and III
(D) I, II, and III

16. Transpiration is the loss of water in the form of vapor from the aerial parts of a plant. In broad-leaved agricultural crops, the maximum percentage of transpiration occurs through which structure?
(A) Lenticels
(B) Cuticle
(C) Stomata
(D) Bark

17. Which of the following laboratory instruments is utilized to measure the rate of transpiration by a plant shoot?
(A) Auxanometer
(B) Potometer
(C) Porometer
(D) Tensiometer

18. Despite causing massive water loss, transpiration is often termed a "necessary evil" for plants. Which of the following is its primary physiological benefit?
(A) It significantly reduces the overall application requirement of synthetic nitrogenous fertilizers.
(B) It systematically enhances the overall rate of photorespiration within all C3 crop plants.
(C) It directly converts incident solar radiation into stored chemical energy inside plant tissues.
(D) It cools leaf surfaces and creates a transpirational pull for sap ascent.

19. Environmental factors strongly influence the water balance of plants. If the relative humidity of the surrounding air increases from 40% to 80%, what will be the effect on the rate of transpiration?
(A) It will decrease.
(B) It will increase proportionally.
(C) It will remain completely unchanged.
(D) It will double.

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20. How does a sudden occurrence of high wind velocity initially affect the rate of transpiration before stomatal closure is induced?
(A) It continuously reduces the overall transpiration rate by depositing surface moisture on leaves.
(B) It completely halts transpiration by immediately freezing the outer epidermal leaf surface layer.
(C) It increases transpiration by removing the saturated boundary air layer.
(D) It maintains a completely unchanged rate of transpiration until ambient temperature drops.

21. In agriculture, certain chemicals are sprayed on crops during drought to reduce water loss. Which of the following chemicals acts as a stomata-closing type antitranspirant?
(A) Phenylmercuric acetate (PMA)
(B) Chlormequat chloride / Cycocel (CCC)
(C) Indole-3-butyric acid auxin (IBA)
(D) Ethylene gas plant regulator

22. The microscopic pore of a stoma is structurally flanked by two specialized, kidney-shaped or dumbbell-shaped epidermal cells. What are these cells called?
(A) Subsidiary cells
(B) Bulliform cells
(C) Mesophyll cells
(D) Guard cells

23. The opening and closing mechanism of stomata is largely governed by changes in the turgor pressure of the guard cells. The influx and efflux of which specific mineral ion primarily regulates this mechanism?
(A) Calcium
(B) Potassium
(C) Phosphorus
(D) Iron

24. Consider the following statements regarding stomata and transpiration:
I. Monocot plants like sugarcane typically possess dumbbell-shaped guard cells.
II. Sugarcane leaves are amphistomatic, meaning stomata are present on both upper and lower surfaces.
III. Stomata generally open during the night and close during the day in C3 crop plants.
IV. Accumulation of Abscisic Acid (ABA) under moisture stress induces rapid stomatal closure.
Which of the above statement(s) is/are correct?
(A) I, II, and III
(B) I, II, and IV
(C) II, III, and IV
(D) I, III, and IV

25. In the internal anatomy of a plant root, the distinct layer of cells that features Casparian strips and regulates the flow of water into the vascular cylinder is known as the:
(A) Epidermis
(B) Cortex
(C) Pericycle
(D) Endodermis

26. Which of the following is a characteristic feature of the vascular bundles in a monocotyledonous stem, such as that of a sugarcane plant?
(A) Scattered in ground tissue, closed type
(B) Distinctly arranged in a continuous vascular ring, open type
(C) Concentrated exclusively within the exact center, open type
(D) Formed in a central star-shaped arrangement, without phloem

27. The leaves of sugarcane and other grasses contain large, bubble-shaped epidermal cells that lose turgor during severe water stress, causing the leaf to roll up and minimize water loss. What are these cells called?
(A) Bundle sheath cells
(B) Bulliform cells
(C) Guard cells
(D) Trichomes

28. Plant tissues are divided into various types based on their function. Which complex permanent tissue is primarily responsible for the bidirectional translocation of synthesized food (sucrose) from leaves to storage organs?
(A) Xylem
(B) Phloem
(C) Collenchyma
(D) Sclerenchyma

29. Match List I with List II and select the correct option:
List I: Plant Tissue/Structure
P. Xylem
Q. Phloem
R. Apical Meristem
S. Parenchyma

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18. (D) It cools leaf surfaces and creates a transpirational pull for sap ascent.
Transpiration dissipates excessive solar heat via evaporative cooling, preventing leaf tissue thermal damage during high solar exposure. Additionally, continuous evaporation creates negative hydrostatic pressure within xylem vessels. This transpirational pull drives the uninterrupted ascent of sap, transporting water and dissolved inorganic soil nutrients from root networks up to apical leaves, sustaining metabolic processes and cellular turgidity throughout the plant.

19. (A) It will decrease.
Transpiration rates depend heavily on the vapor pressure gradient between internal leaf intercellular spaces and ambient air. High relative humidity increases water vapor pressure in external atmosphere, narrowing the diffusion gradient. As atmospheric moisture increases from forty to eighty percent, water vapor diffuses more slowly out of stomatal pores, resulting in a distinct decrease in overall transpiration rates.

20. (C) It increases transpiration by removing the saturated boundary air layer.
Under calm atmospheric conditions, transipring leaves form a thin layer of humid, water-saturated boundary air over stomatal pores, which slows moisture diffusion. Sudden moderate wind velocity sweeps away this boundary layer, surrounding the leaf surface with drier ambient air. This steepens the water vapor concentration gradient, initially accelerating the rate of transpiration prior to wind-induced stomatal closure.

21. (A) Phenylmercuric acetate (PMA)
Phenylmercuric acetate is a chemical compound applied as a stomata-closing antitranspirant during crop water deficit. When sprayed at low concentrations on foliage, it inhibits guard cell photosynthetic reactions and metabolic processes, inducing partial stomatal closure. This reduces transpirational water loss without completely halting carbon dioxide absorption required for crop survival, preserving tissue hydration during prolonged field drought.

22. (D) Guard cells
Stomatal complexes comprise a central microscopic pore flanked by two specialized epidermal cells known as guard cells. In dicotyledonous plants, guard cells exhibit kidney shapes, whereas monocot species like grasses possess dumbbell-shaped guard cells. Reversible osmotic fluid influx and structural cell wall thickening regulate turgor pressure changes within guard cells, opening and closing the stomatal aperture during daily cycles.

23. (B) Potassium
Active movement of potassium ions drives osmotic stomatal movements in guard cells. During daylight, light stimulates proton pumps to export hydrogen ions, causing rapid uptake of potassium ions alongside organic anions into guard cells. This solute accumulation lowers internal osmotic potential, drawing water inside, increasing turgor pressure, and causing guard cells to bow outward, effectively opening the central stomatal pore.

24. (B) I, II, and IV
Monocot crops like sugarcane feature dumbbell-shaped guard cells and amphistomatic leaves with stomata on both surfaces. Under soil moisture stress, plant tissues synthesize abscisic acid, inducing potassium efflux and rapid stomatal closure to prevent dehydration. In standard C3 and C4 crops, stomata open during daylight for photosynthetic gas exchange and close at night, unlike CAM species.

25. (D) Endodermis
The endodermis forms the innermost cellular boundary of the root cortex surrounding vascular tissues. Endodermal cell walls contain continuous radial and transverse bands of suberin called Casparian strips. These hydrophobic strips block apoplastic water movement, forcing water and dissolved mineral ions through selective plasma membranes into symplastic pathways, thereby precisely controlling solute uptake into the central xylem stream.

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26. (A) Scattered in ground tissue, closed type
Stems of monocotyledonous plants like sugarcane display numerous vascular bundles scattered randomly throughout parenchymatous ground tissue rather than arranged in concentric rings. These vascular bundles are classified as closed type because they lack lateral vascular cambium between primary xylem and phloem. Consequently, monocot stems do not exhibit secondary growth or continuous ring formation typical of dicotyledonous plant stems.

formulation (Ethephon) to accelerate maturity and ripening in fruits and sugarcane?
(A) Methane
(B) Nitrous oxide
(C) Ethylene
(D) Carbon monoxide

41. The vast majority of water absorbed by a plant from the soil is taken up through which specific region of the root system?
(A) Root cap zone
(B) Meristematic zone
(C) Zone of elongation
(D) Root hair zone

42. Select the correct physiological sequence representing the radial pathway of water movement from the soil into the root vascular system:
(A) Soil → Root hair → Cortex → Endodermis → Pericycle → Xylem
(B) Soil → Cortex → Epidermis → Xylem → Endodermis
(C) Soil → Endodermis → Pericycle → Root hair → Xylem
(D) Soil → Pericycle → Cortex → Root hair → Endodermis

43. The widely accepted physiological theory explaining the upward transport of water (ascent of sap) through tall trees and large crops is the Cohesion-Tension theory. Who proposed this theory?
(A) J.C. Bose
(B) Dixon and Joly
(C) Julius von Sachs
(D) Melvin Calvin

44. Essential mineral nutrients play specific structural roles in plant physiology. Which secondary macronutrient is the central atom in the porphyrin ring of the chlorophyll molecule?
(A) Iron
(B) Magnesium
(C) Calcium
(D) Manganese

45. Match List I with List II and select the correct option:
List I: Mineral Element
P. Nitrogen
Q. Potassium
R. Phosphorus
S. Zinc

List II: Specific Physiological Role
1. Component of energy-rich compounds (ATP)
2. Stomatal regulation and turgor maintenance
3. Precursor for auxin (tryptophan) synthesis
4. Major constituent of amino acids and proteins

(A) P-4, Q-2, R-1, S-3
(B) P-1, Q-3, R-4, S-2
(C) P-4, Q-1, R-2, S-3
(D) P-2, Q-4, R-3, S-1

46. A critical physiological disorder in agriculture, characterized by stunted growth, short internodes (rosetting), and diseases like "Khaira" in rice, is triggered by the deficiency of which micronutrient?
(A) Boron
(B) Molybdenum
(C) Zinc
(D) Copper

47. In sugarcane physiology, heavy nitrogen application enhances vegetative growth but delays maturity. Which essential nutrient must be adequately supplied to facilitate the translocation of sugars and improve the overall sugar recovery percentage?
(A) Calcium
(B) Sulfur
(C) Chlorine
(D) Potassium

48. Photoperiodism is the physiological reaction of plants to the relative lengths of daylight and darkness. Based on its requirement for a dark period exceeding a critical length to initiate flowering, traditional sugarcane is classified as a:
(A) Long-day plant
(B) Day-neutral plant
(C) Short-day plant
(D) Quantitative long-day plant

49. The detection of photoperiodic stimuli in the leaves of plants is carried out by a specific photoreceptor protein pigment. What is the name of this pigment?
(A) Cytochrome
(B) Phytochrome
(C) Xanthophyll
(D) Carotene

50. Consider the following statements regarding photoperiodism and flowering:

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I. Short-day plants require an uninterrupted period of darkness to induce flowering.
II. A brief flash of red light during the critical dark period will inhibit flowering in short-day plants.
III. Day-neutral plants (like tomato and sunflower) can flower under any photoperiod.

Which of the above statement(s) is/are correct?
(A) I and II
(B) II and III
(C) I and III
(D) I, II, and III

51. The physiological process of inducing or artificially accelerating early flowering in certain crop plants by exposing their imbibed seeds or seedlings to prolonged cold temperatures (0-5°C) is known as:
(A) Vernalization
(B) Scarification
(C) Stratification
(D) Photoperiodism

52. While photoperiodic signals are perceived by mature leaves, the stimulus of cold temperature during vernalization is primarily perceived by the:
(A) Differentiated epidermal root hairs of absorbing roots
(B) Fully expanded mature leaves located on lower stem
(C) Shoot apical meristem or embryo
(D) Outer dermal tissue epidermis of upper stem

53. According to classical plant physiology, what is the name of the hypothetical, flowering-inducing hormone that is synthesized in the leaves and translocated to the apical meristem?
(A) Florigen
(B) Zeatin
(C) Traumatin
(D) Calines

54. In applied crop physiology, premature abscission (dropping) of flowers and immature fruits is a major cause of yield loss. This condition can often be mitigated by spraying low concentrations of which plant hormone?
(A) Abscisic acid
(B) Ethylene gas
(C) Growth retardants (like Maleic Hydrazide)
(D) Auxins (like NAA)

55. When agricultural crops suffer from severe water deficit stress, a visible physiological symptom is the drooping of leaves and stems. This occurs fundamentally due to:
(A) Complete enzymatic degradation of leaf chlorophyll
(B) Loss of turgor pressure in cells
(C) Uncontrolled increase in total cell division rate
(D) Excessive uptake and toxicity of heavy metals

56. To adapt to drought and moisture stress, many plants actively accumulate certain compatible solutes inside their cells to lower osmotic potential and retain water. Which amino acid famously acts as an osmoprotectant during such stress?
(A) Glycine
(B) Tyrosine
(C) Proline
(D) Methionine

57. Read the given assertion and reason, and select the correct option:
Assertion (A): During prolonged drought, the synthesis and accumulation of Abscisic Acid (ABA) dramatically increases in plant leaves.
Reason (R): High levels of ABA cause the rapid opening of stomata to increase the rate of transpiration pull and draw more water from dry soils.
(A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
(B) Both Assertion (A) and Reason (R) are true but R is not the correct explanation of A.
(C) Assertion (A) is true but Reason (R) is false.
(D) Assertion (A) is false but Reason (R) is true.

58. High-temperature stress can cause the rapid denaturation of essential metabolic enzymes. To combat this, plants synthesize specific defensive proteins called:
(A) Heat Shock Proteins (HSPs)
(B) Cold Shock Proteins (CSPs)
(C) Membrane aquaporin channel proteins
(D) Anti-pathogenic phytoalexin compounds

59. Consider the following statements regarding temperature stress in agricultural crops:
I. Freezing injury is characterized by the lethal formation of ice crystals inside or between plant cells.
II. Elevated temperatures generally decrease

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the rate of respiration in plant tissues.
III. Chilling injury affects tropical crops (like sugarcane) when exposed to cold temperatures that are above the freezing point.
IV. The optimum physiological temperature for the active vegetative growth phase of sugarcane is between 30°C and 35°C.

Which of the above statement(s) is/are correct?
(A) I, II, and III
(B) I, III, and IV
(C) II, III, and IV
(D) I, II, and IV

60. The process of "hardening" young seedlings before transplanting makes them more resilient to cold and drought stress. Physiologically, this hardening process involves:
(A) Markedly increasing free tissue water while decreasing total dry matter content
(B) Reducing free water and increasing soluble sugars
(C) Rapidly increasing soil application rates of nitrogenous urea fertilizers
(D) Storing seedling trays in complete darkness for several consecutive weeks

61. Seed germination marks the resumption of active growth by the embryo. Which of the following is the very first physical-physiological process that initiates germination when a dry seed is placed in moist soil?
(A) Imbibition of water by the seed coat
(B) De novo synthesis and activation of hydrolytic alpha-amylase
(C) Physical emergence of primary radicle through seed coat
(D) Active cellular division and elongation within the plumule

62. Arrange the following physiological stages of seed germination in the correct chronological sequence:
1. Emergence of the radicle through the seed coat
2. Imbibition of water and swelling of the seed
3. Activation and de novo synthesis of hydrolytic enzymes
4. Enzymatic breakdown and translocation of stored food to the embryo axis

(A) 2, 3, 4, 1
(B) 2, 4, 3, 1
(C) 3, 2, 4, 1
(D) 1, 2, 3, 4

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63. Some agricultural seeds fail to germinate even when provided with favorable moisture, oxygen, and temperature. If this dormancy is caused by the presence of internal inhibitors like phenolic compounds and ABA, it is termed:
(A) Physical dormancy
(B) Morphological dormancy
(C) Photodormancy
(D) Chemical dormancy

64. Standard physiological prerequisites for the initial stages of seed germination include adequate moisture, optimal temperature, and sufficient oxygen. Which of the following environmental factors is generally NOT required for the initial germination of most standard field crop seeds (like wheat and pulses)?
(A) Water
(B) Oxygen
(C) Light
(D) Favorable temperature

65. Sugarcane physiology is unique due to its massive capacity to store sugars. Sucrose is synthesized in the green leaves and translocated downwards to be stored primarily within the:
(A) Lignified xylem conducting vessels within the root system
(B) Parenchyma vacuoles of stem internodes
(C) Structural sclerenchymatous vascular bundle sheaths
(D) Specialized outer epidermal cells of mature leaves

66. The ripening phase of a sugarcane crop indicates physiological maturity. This ripening process is physically characterized by:
(A) Continuous top-to-bottom sucrose accumulation accompanied by rising tissue moisture
(B) Rapid production and accumulation of simple reducing sugars like glucose and fructose
(C) Continuous vigorous formation and growth of late tillers and vegetative water shoots
(D) Bottom-to-top sucrose accumulation with decreasing stem moisture

67. Select the correct physiological sequence that maps the movement and storage of carbohydrates in a mature sugarcane plant:
(A) Photosynthesis in mesophyll → Sucrose synthesis in leaf → Transport via phloem → Storage in stem vacuoles

(B) Photosynthesis in stem → Starch synthesis → Transport via xylem → Storage in roots
(C) Sucrose synthesis in roots → Transport via phloem → Storage in leaf vacuoles → Respiration
(D) Photosynthesis in bundle sheath → Fructose synthesis → Transport via xylem → Storage in flowers

68. Consider the following statements regarding the accumulation of sugar in sugarcane:
I. Cool night temperatures (around 12-14°C) combined with bright sunny days favor maximum sucrose accumulation.
II. Heavy application of nitrogen fertilizers just before harvesting dramatically accelerates the synthesis of sucrose.
III. As the cane approaches physiological maturity, the concentration of reducing sugars (glucose and fructose) in the juice decreases.
Which of the above statement(s) is/are correct?
(A) I and II
(B) II and III
(C) I and III
(D) I, II, and III

69. Field-level physiological maturity of a sugarcane crop is confirmed using a hand refractometer. A crop is generally considered mature and ready for harvesting when the brix ratio between the top and bottom portions of the cane is approximately:
(A) 0.5
(B) 0.8
(C) 1.0
(D) 1.5

70. In crop physiology, the efficiency of a plant in transferring photosynthates into the economically useful parts is critical. The ratio of economic yield to total biological yield is termed as:
(A) Seed Index
(B) Crop Growth Rate
(C) Leaf Area Ratio
(D) Harvest Index

71. Read the given assertion and reason, and select the correct option:
Assertion (A): At the crop level, C4 plants like sugarcane generally exhibit higher biological yield per hectare than C3 crops under hot, tropical conditions.
Reason (R): C4 plants bypass photorespiration and can maintain high rates of photosynthesis even with partially closed stomata due to their specialized carbon-concentrating mechanism.
(A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
(B) Both Assertion (A) and Reason (R) are true but R is not the correct explanation of A.
(C) Assertion (A) is true but Reason (R) is false.
(D) Assertion (A) is false but Reason (R) is true.

72. Leaf Area Index (LAI) is a significant physiological parameter defining crop canopy architecture. For maximizing photosynthesis and ultimately crop yield, maintaining an optimum LAI ensures:
(A) Complete light shading of lower leaf layers to halt dark respiration
(B) Uncontrolled and rapid depletion of available soil moisture reserves
(C) Optimal light interception without mutual shading
(D) Maximum outward reflection of total incident solar radiation

73. In the practical application of Plant Growth Regulators (PGRs) in agriculture, chemicals like Cycocel (CCC) are extensively used to:
(A) Induce rapid adventitious rooting in hardwood stem cuttings
(B) Artificially accelerate uniform ripening of harvested fruits
(C) Effectively break bud dormancy in stored potato seed tubers
(D) Suppress vegetative growth and lodging in crops

74. Match List I with List II and select the correct option:
List I: Plant Growth Regulator / Chemical
P. Naphthalene Acetic Acid (NAA)
Q. Ethephon (Ethrel)
R. Maleic Hydrazide (MH)
S. Gibberellic Acid (GA3)
List II: Practical Agricultural Use
1. Sprouting suppression in onions and potatoes during storage
2. Prevention of premature flower and fruit drop
3. Increasing internode length to boost sugarcane tonnage
4. Chemical ripening of sugarcane and fruits
(A) P-2, Q-4, R-1, S-3
(B) P-1, Q-3, R-2, S-4
(C) P-4, Q-2, R-3, S-1

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(D) P-2, Q-1, R-4, S-3

75. Consider the following statements about the use of Plant Growth Regulators (PGRs) specifically in sugarcane agriculture:

I. Ethrel sprays are utilized in certain countries to induce early ripening and enhance sugar recovery.

II. Application of Gibberellic Acid during the grand growth phase promotes stalk elongation.

III. Cytokinins are heavily applied at maturity to completely halt the process of photosynthesis.

IV. Polaris and Glyphosate (at very low sub-lethal doses) have been used as chemical ripeners in sugarcane.

Which of the above statement(s) is/are correct?

(A) I, II, and III
(B) I, II, and IV
(C) II, III, and IV
(D) I, III, and IV

76. Certain synthetic plant hormones are also used as herbicides in field practice. Which of the following synthetic auxins is widely applied as a selective systemic herbicide for controlling broad-leaved weeds in sugarcane and wheat fields?

(A) Indole-3-butyric acid rooting hormone (IBA)
(B) 2,4-D auxin
(C) Kinetin synthetic cytokinin derivative
(D) Paclobutrazol triazole growth inhibitor

77. Plants growing in extreme environments develop distinct anatomical and physiological features. Xerophytes adapt to severe dry environments primarily by developing:

(A) Sunken stomata, thick cuticles, and reduced leaves
(B) Exceptionally thin protective cuticles and broad expanded leaf blades
(C) Extensive interconnected aerenchyma tissue throughout root systems
(D) Abundant large intercellular air space cavities in leaf mesophyll

78. Hydrophytes are plants structurally adapted to live in aquatic environments. Which of the following internal tissue adaptations is highly characteristic of hydrophytes, enabling buoyancy and gas exchange under water?

(A) Massive secondary xylem
(B) Well-developed palisade parenchyma
(C) Extensive aerenchyma
(D) Multiple layers of suberized bark

79. Consider the following statements regarding the environmental adaptations of specific plant types:

I. Halophytes growing in waterlogged, saline soils often develop pneumatophores (respiratory roots) for oxygen exchange.

II. Hydrophytes typically possess an exceptionally deep, highly branched, and extensive root system.

III. The CAM (Crassulacean Acid Metabolism) photosynthetic pathway is an evolutionary adaptation in desert succulents to minimize transpirational water loss.

Which of the above statement(s) is/are correct?

(A) I and II
(B) II and III
(C) I and III
(D) I, II, and III

80. Sugarcane displays excellent adaptability to diverse tropical environments. Structurally, it develops a deep and extensive fibrous root system from the sett and shoot base. Physiologically, this root system primarily aids the plant by:

(A) Directly absorbing atmospheric nitrogen gas through specialized root nodule structures
(B) Synthesizing exceptionally high concentrations of florigen hormone in vegetative tissues
(C) Providing anchorage against lodging and accessing deep sub-soil moisture
(D) Rapidly storing massive reserves of sucrose underground during cold winter months

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ANSWERS

1. (B) Grana of the chloroplast
Photosynthesis consists of light-dependent and light-independent reactions occurring within plant chloroplasts. The light-dependent reactions involve the absorption of solar energy by chlorophyll pigments, leading to water photolysis and ATP generation. These membrane-bound reactions take place specifically within the thylakoid membranes arranged in stacks known as grana, whereas dark reactions occur inside the surrounding stroma fluid.

2. (D) Phosphoglyceric acid (PGA)
In C3 photosynthetic pathways, atmospheric carbon dioxide enters the Calvin cycle by binding with ribulose bisphosphate in a reaction catalyzed by RuBisCO enzyme. This unstable intermediate instantly splits into two molecules of three-carbon phosphoglyceric acid. Consequently, phosphoglyceric acid serves as the very first stable organic chemical compound produced during carbon fixation within the stroma of chloroplasts.

3. (A) Photolysis of water
During the light-dependent stage of photosynthesis, light energy absorbed by photosystem II drives the catalytic splitting of water molecules into hydrogen ions, electrons, and molecular oxygen. This photochemical splitting process is termed photolysis. The liberated electrons replenish those lost by reaction center chlorophylls, while the produced molecular oxygen is released into the atmosphere as a metabolic byproduct.

4. (C) C4 pathway, Oxaloacetic acid
Sugarcane operates via the C4 photosynthetic pathway, which minimizes photorespiration and enhances water and nitrogen efficiency in tropical environments. In mesophyll cells, phosphoenolpyruvate carboxylase fixes atmospheric carbon dioxide into phosphoenolpyruvate, forming a four-carbon dicarboxylic acid called oxaloacetic acid. Oxaloacetic acid represents the initial stable metabolic product before being converted into malate and transported to bundle sheath cells.

5. (A) Kranz anatomy
C4 plants possess a specialized leaf tissue arrangement known as Kranz anatomy, derived from the German word for wreath. Chloroplast-containing mesophyll cells surround inner bundle sheath cells in concentric layers around vascular bundles. Structural spatial separation isolates primary carbon carboxylation from the Calvin cycle, elevating carbon dioxide concentrations around RuBisCO to suppress photorespiration under high solar intensity.

6. (D) P-4, Q-1, R-3, S-2
Plant species utilize different photosynthetic adaptations based on environmental conditions. Wheat functions as a temperate C3 plant using phosphoglyceric acid synthesis. Sugarcane utilizes the C4 pathway with spatial carbon fixation. Pineapple is a succulent CAM plant fixing carbon dioxide nocturnally to conserve water. Hydrilla represents a submerged hydrophyte performing aquatic carbon uptake within aquatic ecosystems.

7. (B) Negligible or minimal photorespiration
C4 crops exhibit superior dry matter production per unit water loss compared to C3 plants primarily because photorespiration is virtually absent. The enzymatic activity of PEP carboxylase concentrates carbon dioxide within bundle sheath cells around RuBisCO. This elevated carbon concentration prevents oxygenase activity, eliminating energy waste and allowing efficient carbon assimilation even when stomata partially close.

8. (C) They do not reach light saturation even under full sunlight.
Tropical C4 crops such as sugarcane possess an exceptionally high photosynthetic capacity and do not reach light saturation even under full natural sunlight. Their unique carbon-concentrating mechanism prevents RuBisCO oxygenation, enabling continuous increases in carbon assimilation rates as irradiance rises. Consequently, C4 plants efficiently utilize high intensity solar radiation without experiencing light saturation under field conditions.

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9. (A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
C4 plants maintain active carbon fixation under extremely low intercellular carbon dioxide levels because mesophyll cells contain phosphoenolpyruvate carboxylase. This enzyme possesses a high affinity for carbon dioxide and lacks oxygenase activity, unlike RuBisCO. Therefore, PEP carboxylase efficiently captures trace carbon dioxide, supplying malate to bundle sheath cells and maintaining high photosynthesis rates during drought-induced stomatal constriction.

10. (C) 30 to 35 degree Celsius
Tropical C4 crops like sugarcane exhibit optimum photosynthetic efficiency within a high temperature range of thirty to thirty-five degrees Celsius. Their metabolic enzymes, particularly PEP carboxylase, function maximally in warm environments. Unlike temperate C3 plants whose optimal range lies lower, C4 species thrive under high thermal regimes without suffering elevated photorespiratory losses or thermal denaturation of photosynthetic enzymes.

11. (B) Cytoplasm
Glycolysis is the preliminary sequence of respiratory reactions occurring universally in anaerobic and aerobic organisms. This metabolic pathway breaks down one hexose sugar molecule into two pyruvate molecules without requiring molecular oxygen. Because all necessary soluble glycolytic enzymes reside within the liquid cytosol of the cell, glycolysis takes place entirely inside the cytoplasm rather than organelle interiors.

12. (D) 38 ATP
Complete aerobic degradation of a single glucose molecule through glycolysis, pyruvate oxidation, the citric acid cycle, and oxidative phosphorylation yields approximately thirty-eight adenosine triphosphate molecules under classic biological accounting. Eight ATP are generated in cytosolic glycolysis, six during pyruvate decarboxylation, and twenty-four within the mitochondrial matrix and inner membrane via electron transport chain reactions.

13. (C) 1.0
The Respiratory Quotient represents the volume ratio of carbon dioxide produced to oxygen consumed during cell respiration. When pure carbohydrates like sucrose or glucose act as substrates, complete aerobic oxidation requires an equal volume of oxygen gas as the carbon dioxide evolved. Hence, carbohydrate respiration yields a mathematical ratio of six carbon dioxide to six oxygen molecules, equaling unity.

14. (C) Ethyl alcohol and carbon dioxide
Under flooded or waterlogged soil conditions, depleted root oxygen induces anaerobic respiration or alcoholic fermentation. In plant cells, pyruvate generated via glycolysis is converted by pyruvate decarboxylase and alcohol dehydrogenase into ethyl alcohol and carbon dioxide, producing minor ATP quantities. Accumulation of ethanol in stagnant waterlogged roots can cause metabolic toxicity if prolonged flooding persists.

15. (C) I and III
Anaerobic respiration occurs entirely within the cytoplasm because mitochondrial oxidative processes require molecular oxygen. It involves partial oxidation of respiratory substrates like glucose, yielding end products such as ethanol and carbon dioxide alongside minimal energy output of two ATP per glucose. Consequently, energy production is significantly lower than aerobic respiration, which completely oxidizes glucose into water and carbon dioxide.

16. (C) Stomata
Transpiration is the evaporative loss of water vapor from plant shoot tissues. While small water volumes escape through cuticular surfaces or stem lenticels, over ninety percent of total transpiration in broad-leaved crops takes place through microscopic stomatal pores. Stomata, concentrated predominantly on leaf surfaces, regulate gas exchange and moisture loss through controlled opening and closing of surrounding guard cells.

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17. (B) Potometer
A potometer is a laboratory instrument designed to measure the rate of transpiration by tracking water absorption speed in a cut plant shoot. By measuring the movement of an air bubble inside a calibrated capillary tube attached to the shoot system, researchers infer water loss rates. Auxanometers track stem elongation, whereas tensiometers measure soil moisture tension.

List II: Primary Function
1. Primary linear growth of shoot and root
2. Storage of food and filling tissue
3. Upward transport of water and minerals
4. Translocation of photosynthates

(A) P-3, Q-4, R-1, S-2
(B) P-4, Q-3, R-2, S-1
(C) P-3, Q-1, R-4, S-2
(D) P-1, Q-2, R-3, S-4

30. The rapid elongation of internodes seen in the stalks of sugarcane is physiologically driven by the continuous division activity of which specific type of meristematic tissue?
(A) Secondary lateral meristem tissue
(B) Secondary cork cambium tissue
(C) Intercalary meristem
(D) Lateral vascular cambium tissue

31. Plant metabolism involves a complex network of chemical reactions. Which of the following physiological processes is best described as an anabolic process?
(A) Glycolysis
(B) Photorespiration
(C) Beta-oxidation of fatty acids
(D) Photosynthesis

32. During the germination of a seed, complex stored starches are broken down into simpler soluble sugars to nourish the growing embryo. This specific breakdown process represents:
(A) Anabolic metabolism
(B) Carbon fixation
(C) Catabolic metabolism
(D) Photophosphorylation

33. The Pentose Phosphate Pathway (PPP) is an alternative route for glucose metabolism in plants that generates NADPH. In which cellular compartment does this process predominantly occur?
(A) Nucleus
(B) Cytoplasm
(C) Golgi apparatus
(D) Endoplasmic reticulum

34. Plant Growth Regulators (PGRs) are crucial for controlling physiological processes. Which was the first naturally occurring plant hormone to be discovered and isolated?
(A) Gibberellin
(B) Cytokinin
(C) Ethylene
(D) Auxin

35. In modern agricultural physiology, which plant hormone is widely recognized as the "stress hormone" due to its rapid accumulation under adverse conditions like severe drought?
(A) Abscisic Acid (ABA)
(B) Indole-3-Acetic Acid (IAA)
(C) Gibberellic Acid (GA3)
(D) Zeatin

36. Which of the following is an endogenous (naturally synthesized) auxin found in most agricultural crops?
(A) 2,4-Dichlorophenoxyacetic acid (2,4-D)
(B) Naphthalene Acetic Acid (NAA)
(C) Indole-3-Acetic Acid (IAA)
(D) Maleic Hydrazide (MH)

37. To maximize the yield of sugarcane, agricultural practices sometimes involve spraying a specific plant hormone during the grand growth phase to significantly increase the length of the internodes. Which hormone is utilized for this purpose?
(A) Gibberellic Acid
(B) Abscisic Acid stress hormone
(C) Gaseous ethylene hormone
(D) Kinetin cytokinin compound

38. The class of plant hormones known as cytokinins derives its name from its primary physiological role in promoting:
(A) Suppression of lateral bud proliferation
(B) Rapid internodal extension growth
(C) Induction of rapid stomatal closure
(D) Cell division

39. Read the given assertion and reason, and select the correct option:
Assertion (A): Pruning or removal of the apical bud (shoot apex) in certain crop plants promotes a bushy growth with many lateral branches.
Reason (R): The apical bud synthesizes auxins that move downward and inhibit the sprouting and growth of lateral buds.
(A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
(B) Both Assertion (A) and Reason (R) are true but R is not the correct explanation of A.
(C) Assertion (A) is true but Reason (R) is false.
(D) Assertion (A) is false but Reason (R) is true.

40. Which of the following gaseous plant hormones is practically applied in agriculture using its liquid

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27. (B) Bulliform cells
Leaves of sugarcane and various grasses contain specialized, large, thin-walled epidermal cells called bulliform or motor cells on their upper surface. Under optimal moisture conditions, these cells remain turgid, keeping leaf blades flat. During severe water stress, bulliform cells lose turgor pressure and collapse, causing leaf rolling inward to minimize exposed surface area and reduce transpiration.

28. (B) Phloem
Phloem is the complex permanent vascular tissue tasked with translocating organic nutrients, primarily sucrose, from photosynthetic source leaves to metabolic sinks such as growing roots, shoots, and storage organs. Composed of sieve tube elements, companion cells, phloem parenchyma, and fibers, it facilitates bidirectional sap transport driven by hydrostatic pressure gradients established through active sucrose loading and unloading processes.

29. (A) P-3, Q-4, R-1, S-2
Plant tissues perform specialized functions within plant anatomy. Xylem conducts water and inorganic minerals upward from roots. Phloem translocates photosynthesized organic nutrients like sucrose throughout plant structures. Apical meristems located at root and shoot tips drive primary growth and linear elongation. Parenchyma functions as living ground tissue responsible for metabolic storage and filling organ intercellular spaces.

30. (C) Intercalary meristem
Intercalary meristematic tissue resides at internode bases and node junctions of monocotyledonous stems, particularly within grasses and sugarcane stalks. Derived from primary apical meristem during tissue differentiation, intercalary meristems retain active cell division capabilities. Rapid mitotic divisions within these regions promote internodal elongation, driving stalk extension growth, recovery from wind damage, and rapid regrowth after harvesting.

31. (D) Photosynthesis
Photosynthesis is a constructive anabolic pathway in green plants wherein simple inorganic carbon dioxide and water molecules synthesize energy-rich organic carbohydrates utilizing absorbed light energy. Conversely, processes like glycolysis, photorespiration, and beta-oxidation represent catabolic pathways that break down complex organic substrates into simpler compounds, releasing stored chemical energy or generating precursor metabolites for plant cellular maintenance.

32. (C) Catabolic metabolism
Seed germination initiates intense metabolic activity to nourish the growing embryo. Hydrolytic enzymes such as alpha-amylase decompose complex stored macromolecules, converting insoluble starch reserves into soluble simple sugars like maltose and glucose. This enzymatic degradation of complex cellular nutrients into simpler compounds constitutes catabolic metabolism, generating energy and structural substrates required for initial seedling development.

33. (B) Cytoplasm
The pentose phosphate pathway serves as an alternative cytosolic pathway for glucose oxidation alongside glycolysis. Occurring within the cellular cytoplasm, it breaks down glucose-6-phosphate to generate NADPH and pentose sugar precursors like ribose-5-phosphate. NADPH provides essential reducing power for biosynthetic reactions such as fatty acid synthesis, while pentoses supply structural backbones for nucleic acid synthesis within plant cells.

34. (D) Auxin
Auxin was the first natural plant hormone discovered and characterized in plant physiology. Initial research on phototropism in oat coleoptiles by Charles Darwin and Frits Went led to the isolation of indole-3-acetic acid. Auxins play fundamental roles in controlling cell elongation, apical dominance, vascular tissue differentiation, and adventitious root development across various agricultural crops and plant species.

35. (A) Abscisic Acid (ABA)
Abscisic acid is universally recognized as the primary plant stress hormone due to its rapid biosynthesis under environmental stresses like drought, salinity, and extreme temperatures. When roots experience moisture deficit, abscisic acid translocates to leaves, triggering potassium outflow from guard cells. This causes rapid stomatal closure to prevent transpirational water loss, protecting plant tissues from desiccation.

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36. (C) Indole-3-Acetic Acid (IAA)
Indole-3-acetic acid is the primary naturally occurring endogenous auxin synthesized by plants, predominantly within actively growing shoot apices and young expanding leaves. In contrast, compounds such as 2,4-dichlorophenoxyacetic acid, naphthalene acetic acid, and maleic hydrazide represent synthetic chemical analogs manufactured artificially for agricultural applications like weed control, root induction, and growth regulation in crops.

37. (A) Gibberellic Acid
Exogenous application of gibberellic acid during the grand growth stage of sugarcane significantly stimulates cellular division and elongation within stalk internodes. By increasing internodal length and stem diameter, gibberellic acid treatment dramatically expands total stalk biomass and cane tonnage per hectare, making it a valuable commercial plant growth regulator in sugarcane crop management.

38. (D) Cell division
Cytokinins are a major class of plant hormones named after their essential role in stimulating cytokinesis, or cellular division. Discovered originally as kinetin and zeatin, cytokinins work synergistically with auxins to promote cell proliferation in shoot apices, delay leaf senescence, mobilize metabolic nutrients, and induce lateral bud development by overcoming apical dominance in agricultural crop species.

39. (A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
Shoot tips synthesize auxins that migrate downward through vascular parenchyma, suppressing the growth of axillary lateral buds in a phenomenon called apical dominance. Removing the apical shoot tip eliminates the primary source of polar auxin transport, releasing lateral buds from inhibition. Consequently, lateral buds sprout into branches, transforming crop canopy architecture into a bushier structure.

40. (C) Ethylene
Ethylene is a naturally occurring gaseous plant hormone that regulates fruit ripening, tissue abscission, and floral senescence. In agricultural management, liquid formulations such as ethephon are applied to crops. Ethephon breaks down inside plant tissues to release ethylene gas, which accelerates fruit color development, promotes uniform crop maturity, and improves sucrose accumulation in sugarcane prior to harvest.

41. (D) Root hair zone
The vast majority of water and dissolved mineral ions are absorbed in the root hair zone, situated just behind the region of elongation. Root hairs are microscopic single-cell outer extensions of epidermal cells that enormously expand total root surface area contacting soil particles, thereby maximizing passive osmotic water entry and active mineral ion uptake into root tissue.

42. (A) Soil → Root hair → Cortex → Endodermis → Pericycle → Xylem
Water absorbed from soil follows a defined radial path through root tissues into vascular structures. Soil water enters delicate root hair epidermal cells, traversing parenchymatous cortex tissue via apoplastic or symplastic pathways. Upon reaching the endodermis, water passes through selective cell membranes driven by Casparian strips, crossing the pericycle layer to enter xylem vessels for upward sap transport.

43. (B) Dixon and Joly
The cohesion-tension theory, proposed by Henry Dixon and John Joly in 1894, explains long-distance upward water movement in tall plants. Transpiration from leaves creates high tension or negative pressure in xylem conduits. Strong cohesive forces between polar water molecules, alongside adhesion to xylem walls, maintain uninterrupted water columns, pulling sap continuously from roots to topmost canopies.

44. (B) Magnesium
Magnesium is an essential secondary macronutrient serving as the central coordinating metal atom in the tetrapyrrole ring structure of chlorophyll molecules. Without adequate magnesium, plants cannot synthesize functional chlorophyll, resulting in severe interveinal chlorosis in mature leaves. Furthermore, magnesium acts as an essential enzymatic activator for critical photosynthetic and respiratory enzymes, including RuBisCO and PEP carboxylase.

45. (A) P-4, Q-2, R-1, S-3
Essential minerals perform distinct functions in plant metabolism. Nitrogen forms structural bases for amino acids, proteins, and chlorophyll. Potassium regulates guard cell turgor, stomatal

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movements, and osmotic balance. Phosphorus constitutes ATP, nucleic acids, and phospholipids essential for cellular energy transfer. Zinc functions as an indispensable enzyme cofactor required for tryptophan and auxin growth hormone biosynthesis.

46. (C) Zinc
Zinc deficiency causes significant physiological disruptions in crop growth, notably Khaira disease in paddy rice and rosetting due to stunted internode expansion. Because zinc acts as an essential precursor cofactor for tryptophan synthesis during auxin production, insufficient zinc impairs cell elongation. Affected plants display severe chlorosis, leaf bronzing, shortened internodes, and diminished overall vegetative yield.

47. (D) Potassium
Potassium plays a critical physiological role in sugarcane nutrition by activating enzymes responsible for carbohydrate synthesis and translocating photosynthesized sucrose from leaves to stalk storage vacuoles. While excessive nitrogen favors vegetative leaf growth and delays crop maturity, balanced potassium application accelerates sugar transport, enhances stress tolerance, improves stalk structural firmness, and boosts sucrose recovery percentages during harvest.

48. (C) Short-day plant
Photoperiodism governs reproductive transitions based on relative day and night lengths. Sugarcane is classified as a short-day plant, requiring extended, uninterrupted dark periods exceeding a critical threshold to initiate floral induction. Exposure to long daylight hours inhibits flowering, maintaining vegetative growth, whereas proper short-day light regimes trigger floral primordial development at stem apices under natural conditions.

49. (B) Phytochrome
Photoperiodic light signals are detected within plant leaves by phytochrome, a specialized chromoprotein photoreceptor pigment. Phytochrome exists in two interconvertible forms: red-light absorbing Pr and far-red-absorbing Pfr. The dynamic ratio between these forms tracks environmental daylight duration and dark periods, sending regulatory signals to apical meristems to initiate or suppress flowering response pathways.

50. (D) I, II, and III
Short-day plants require continuous darkness exceeding critical night lengths to induce flowering; a brief red light flash during darkness converts Pfr forms and prevents flowering. Conversely, day-neutral plants like sunflowers flower independently of photoperiod variations. Understanding these photoperiodic mechanisms allows precise management of crop reproductive timing across varied geographical locations and seasonal light environments.

51. (A) Vernalization
Vernalization is the physiological acquisition or acceleration of the ability to flower through prolonged exposure to low cold temperatures, typically between zero and five degrees Celsius. This cold treatment alters gene expression patterns in imbibed seeds or young seedlings, shortening vegetative phases and ensuring reproductive development occurs during favorable post-winter seasonal weather conditions.

52. (C) Shoot apical meristem or embryo
While photoperiodic light signals are perceived by mature leaf tissues, the low-temperature stimulus during vernalization is perceived directly by meristematic regions, particularly the shoot apical meristem or germinating seed embryo. Cold exposure induces epigenetic modifications within apical cells, permitting subsequent floral gene transcription when favorable temperature and photoperiod conditions occur in spring.

53. (A) Florigen
Florigen is the classic hypothetical systemic flowering hormone postulated to form in mature leaves under permissive photoperiodic conditions. Translocated through phloem vascular tissue to shoot apical meristems, florigen triggers reprogramming of vegetative buds into floral primordia. Modern plant biology identifies florigen signal molecules as FT (Flowering Locus T) protein complexes synthesized in leaf vascular companion cells.

54. (D) Auxins (like NAA)
Premature flower and fruit drop causes significant yield loss in commercial crop production, often triggered by auxin depletion in pedicels. Exogenous foliage applications of

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(D) 31 atmospheres

29. Read the given Assertion (A) and Reason (R) and choose the correct option.
Assertion (A): Regular application of heavy farmyard manure (FYM) or pressmud increases the water-holding capacity of sandy soils.
Reason (R): Organic matter improves soil aggregation, creates better porosity, and has a high inherent capacity to absorb and retain water.
(A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
(B) Both Assertion (A) and Reason (R) are true but R is not the correct explanation of A.
(C) Assertion (A) is true but Reason (R) is false.
(D) Assertion (A) is false but Reason (R) is true.

30. Soil temperature plays a critical role in seed sett germination. What is the optimum soil temperature range for the rapid and successful germination of sugarcane setts?
(A) 15°C to 20°C
(B) 20°C to 25°C
(C) 28°C to 32°C
(D) 38°C to 45°C

31. According to the standard classification of salt-affected soils by the US Salinity Laboratory, what are the properties of a typical Saline Soil?
(A) EC $>$ 4 dS/m, ESP $<$ 15, pH $<$ 8.5
(B) EC $<$ 4 dS/m, ESP $>$ 15, pH $>$ 8.5
(C) EC $>$ 4 dS/m, ESP $>$ 15, pH $>$ 8.5
(D) EC $<$ 4 dS/m, ESP $<$ 15, pH $<$ 8.5

32. Which specific problem occurs in alkali (sodic) soils that drastically reduces water infiltration rates and causes poor crop stand?
(A) Aggregation of fine soil particles into large stable clods caused by excess exchangeable calcium ions.
(B) Deflocculation of soil colloids caused by excess exchangeable sodium on the clay complex.
(C) Excessive buildup and accumulation of undecomposed organic residues directly on the soil surface.
(D) Rapid development of extreme subsoil acidity leading to severe and widespread aluminium toxicity.

33. What is the most scientifically sound and widely recommended chemical amendment for the reclamation of problematic barren alkaline (usar) land in Uttar Pradesh?
(A) Application of finely ground agricultural lime (Calcium carbonate)
(B) Application of mineral Gypsum (Calcium sulphate dihydrate)
(C) Application of heavy commercial doses of Urea nitrogen fertilizer
(D) Frequent application of low-quality saline irrigation water sources

34. Consider the following statements regarding the reclamation and management of salt-affected (Usar) lands in Uttar Pradesh:
I. Leaching of soluble salts with good quality water is an essential step after applying chemical amendments.
II. Dhaincha (Sesbania) is commonly grown and incorporated into the soil as green manure during the reclamation process.
III. Sodic soils are reclaimed primarily by adding basic materials like quicklime.
Which of the given combinations of statements is correct?
(A) I and III only
(B) I and II only
(C) II and III only
(D) I, II and III

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35. Under the Soil Health Card Scheme, how many specific parameters of the soil are evaluated to provide a comprehensive fertility status to the farmer?
(A) 8 parameters
(B) 10 parameters
(C) 12 parameters
(D) 16 parameters

36. Among the physical parameters tested under the Soil Health Card Scheme, which parameter is critical for understanding the salinity status of the soil?
(A) Soil pH value
(B) Organic Carbon content
(C) Available Boron concentration
(D) Electrical Conductivity (EC)

37. Sugarcane is a long-duration, heavy-feeding crop. Which physico-chemical soil properties are considered ideal for its successful commercial cultivation in Uttar Pradesh?
(A) Shallow, coarse sandy soils possessing low organic content and alkaline pH values above 8.5

concentrations of growth inhibitors like abscisic acid, phenolic acids, or coumarins prevent embryo growth. Overcoming chemical dormancy requires leaching inhibitors with running water, natural weathering, or applying growth promoters like gibberellins to restore germination capability.

64. (C) Light
Initial seed germination universally requires moisture for tissue imbibition, suitable ambient temperatures for enzymatic activity, and oxygen for cellular respiration. However, light is not required for germinating most standard agricultural crop seeds such as wheat, maize, and pulses. These seeds germinate successfully underground in complete darkness, relying on stored seed food reserves until shoots emerge.

65. (B) Parenchyma vacuoles of stem internodes
Sugarcane exhibits exceptional physiological capacity for carbohydrate storage. Sucrose synthesized in green mesophyll leaves via photosynthesis translocates downward through phloem tissue into the stem stalk. In mature stalks, sucrose moves into large storage parenchyma cells, accumulating within central vacuoles. Storing sucrose in stem parenchyma vacuoles provides energetic reserves while maintaining osmotic stability across stalk tissues.

66. (D) Bottom-to-top sucrose accumulation with decreasing stem moisture
Sugarcane crop ripening indicates physiological maturity, characterized by distinct moisture and carbohydrate changes. Sucrose accumulation progresses systematically from lower stalk internodes upward toward top nodes as vegetative elongation slows. Concurrently, overall stalk tissue moisture content decreases, and non-reducing sugar concentrations drop. High sucrose levels in upper internodes signal complete stalk maturation across the field.

67. (A) Photosynthesis in mesophyll → Sucrose synthesis in leaf → Transport via phloem → Storage in stem vacuoles
Carbohydrate dynamics in sugarcane follow a specific physiological route. Carbon dioxide fixation occurs in photosynthetic leaf mesophyll and bundle sheath cells, producing simple triose phosphates. These sugars form sucrose in leaf cytosol, which loads into phloem sieve tubes. Phloem sap translocates sucrose downward into stem stalks, where active transport deposits it into storage vacuoles.

68. (C) I and III
Maximum sucrose accumulation in sugarcane is favored by cool night temperatures combined with bright sunny days, which reduce respiratory sugar loss while sustaining high photosynthetic rates. As maturity approaches, reducing sugar concentrations drop as they convert into sucrose. Late nitrogen fertilizer application inhibits sucrose storage by promoting undesirable vegetative leaf growth and tiller formation.

69. (C) 1.0
Field maturity of sugarcane is evaluated by measuring juice soluble solids using a hand refractometer. A brix ratio calculated between top and bottom stalk internodes indicates crop maturity stage. When juice brix values at upper internodes equal those at lower internodes, the ratio approaches 1.0, signifying uniform sucrose distribution and optimal harvest timing.

70. (D) Harvest Index
Harvest Index is a physiological metric defined as the ratio of economic yield to total biological yield produced by a crop. It reflects plant efficiency in translocating photosynthesized assimilate from vegetative sources to harvested storage sinks. Higher harvest index values indicate superior assimilate partitioning into harvestable plant structures, driving crop yield improvements in modern agricultural systems.

71. (A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
C4 crops like sugarcane produce higher biological yields per hectare in tropical climates than C3 species because they eliminate photorespiration. The C4 spatial carbon-concentrating mechanism elevates carbon dioxide around RuBisCO in bundle sheath cells, maintaining high photosynthetic rates even under elevated temperatures and partial stomatal closure, resulting in superior biomass accumulation efficiency.

72. (C) Optimal light interception without mutual shading
Leaf Area Index measures total upper leaf surface area per unit ground land area. Maintaining an optimum leaf area index ensures maximum canopy light interception required for driving photosynthesis while preventing severe mutual

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shading of lower foliage. Minimizing mutual shading reduces dark respiration losses in lower leaves, maximizing net assimilate production and overall crop yield.

73. (D) Suppress vegetative growth and lodging in crops
Cycocel, or chlormequat chloride, is a synthetic plant growth retardant that inhibits gibberellin biosynthesis. Applied in agricultural crop management, it restricts excessive stem internode elongation, producing shorter, thicker, sturdier stalks. This suppression of vegetative growth reduces crop lodging risks from wind or rain while diverting metabolic photosynthates toward reproductive structures and storage organs.

74. (A) P-2, Q-4, R-1, S-3
Plant growth regulators serve specific practical agricultural functions. Naphthalene acetic acid prevents premature flower and fruit drop. Ethephon acts as a chemical ripener, accelerating uniform crop maturity in sugarcane and fruits. Maleic hydrazide suppresses onion and potato sprouting during post-harvest storage. Gibberellic acid increases stem internode length, boosting overall sugarcane biomass tonnage per hectare.

75. (B) I, II, and IV
Plant growth regulators enhance sugarcane productivity through specific mechanisms. Ethrel sprays induce early crop ripening, enhancing juice sucrose recovery. Gibberellic acid applications stimulate internodal elongation, increasing stalk tonnage. Sub-lethal chemical sprays like Polaris and glyphosate act as chemical ripeners. However, cytokinins are not used at maturity to halt photosynthesis, as active assimilation remains beneficial.

76. (B) 2,4-D auxin
2,4-Dichlorophenoxyacetic acid is a synthetic auxin widely applied as a selective systemic herbicide in sugarcane and cereal fields. When sprayed at elevated concentrations, broad-leaved dicot weeds absorb 2,4-D rapidly, suffering uncontrolled growth, vascular disruption, and death. Conversely, monocot crop plants metabolize 2,4-D safely, allowing selective weed elimination without harming crop yields.

77. (A) Sunken stomata, thick cuticles, and reduced leaves
Xerophytic plants thrive in arid environments by developing distinct structural adaptations to minimize transpirational water loss. Leaves feature thick waxy cuticles that impede cuticular evaporation, sunken stomata located within protected pits to trap humid microclimates, and reduced leaf surface areas or spines, enabling plants to maintain hydration and survive prolonged soil drought conditions.

78. (C) Extensive aerenchyma
Hydrophytes possess specialized anatomical features adapting them to aquatic environments. A prominent characteristic is well-developed aerenchyma tissue containing large interconnected air spaces throughout stems, roots, and leaves. Aerenchyma provides internal buoyancy, allowing floating or submerged organs to remain suspended, while facilitating gas exchange and internal oxygen diffusion down to submerged root structures.

79. (C) I and III
Halophytes in flooded saline soils form specialized vertical roots called pneumatophores equipped with lenticels for root oxygen exchange. Succulents in arid environments employ Crassulacean Acid Metabolism, opening stomata at night to fix carbon dioxide into organic acids, closing them during daylight to prevent transpirational water loss while completing photosynthesis. Hydrophytes typically develop reduced, shallow root systems.

80. (C) Providing anchorage against lodging and accessing deep sub-soil moisture
Sugarcane develops a dual root system comprising short-lived sett roots and permanent, deeply penetrating shoot roots from lower stem nodes. This extensive fibrous root network firmly anchors tall, heavy stalks against wind-induced lodging. Furthermore, deep root penetration allows uptake of sub-soil water and dissolved nutrients, maintaining crop hydration and growth during dry periods.

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CHAPTER 12
Soil Properties and Formation Process

1. In the volumetric composition of an ideal agricultural soil, what is the optimal percentage of mineral matter and organic matter respectively?
(A) 25 percent mineral matter and 25 percent organic matter
(B) 45 percent mineral matter and 5 percent organic matter
(C) 50 percent mineral matter and 10 percent organic matter
(D) 40 percent mineral matter and 20 percent organic matter

2. Which of the following physical properties of soil is considered a basic, static property that cannot be easily altered by standard tillage operations?
(A) Soil texture
(B) Soil structure
(C) Soil bulk density
(D) Soil porosity

3. According to the International Society of Soil Science (ISSS) classification, what is the standard diameter of clay particles?
(A) Less than 0.002 mm
(B) 0.002 mm to 0.02 mm
(C) 0.02 mm to 0.2 mm
(D) 0.2 mm to 2.0 mm

4. Which type of soil structure is considered most ideal for seed germination and general crop growth, particularly for a deep-rooted crop like sugarcane?
(A) Platy structure
(B) Prismatic structure
(C) Blocky structure
(D) Crumb structure

5. Which of the following is considered an active factor of soil formation?
(A) Parent material
(B) Topography
(C) Climate
(D) Time

6. The Munsell colour system determines soil colour based on three distinct variables. Which of the following is NOT one of these variables?
(A) Hue
(B) Tint
(C) Value
(D) Chroma

7. Read the given Assertion (A) and Reason (R) and choose the correct option.
Assertion (A): Cation Exchange Capacity (CEC) is generally higher in clay soils compared to sandy soils.
Reason (R): Clay particles and humus possess a net negative charge on their surface which attracts and holds positively charged ions.
(A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
(B) Both Assertion (A) and Reason (R) are true but R is not the correct explanation of A.
(C) Assertion (A) is true but Reason (R) is false.
(D) Assertion (A) is false but Reason (R) is true.

8. What is the typical Carbon to Nitrogen (C:N) ratio of well-decomposed soil organic matter (humus) in normal arable Indian soils?
(A) 5:1 to 8:1
(B) 10:1 to 12:1
(C) 20:1 to 25:1
(D) 30:1 to 40:1

9. Which biological organism in the soil is primarily responsible for the characteristic earthy smell of soil after the first rainfall and plays a major role in decomposing complex organic residues?
(A) Rhizobium
(B) Blue-green algae
(C) Actinomycetes
(D) Nematodes

10. Consider the following statements regarding the effect of soil pH on nutrient availability:
I. Phosphorus availability is maximum in the neutral pH range of 6.5 to 7.5.
II. Iron, manganese, and zinc are more available in strongly acidic soils.
III. Molybdenum availability decreases as the soil becomes more alkaline.
IV. High soil pH (above 8.5) often induces

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calcium and magnesium toxicity.
Which of the given combinations of statements is correct?
(A) I and II only
(B) I, II and IV only
(C) II and III only
(D) I, III and IV only

11. In a typical soil profile, which horizon is known as the zone of maximum eluviation (washing out) of clay, iron, and aluminium oxides?
(A) O organic horizon
(B) A2 or E horizon
(C) B illuvial horizon
(D) C parent rock horizon

12. Match the soil types in List I with their predominant characteristic or mineral in List II and select the correct option.
List I: Soil Types
P. Black Cotton Soil
Q. Red Soil
R. Laterite Soil
S. Peaty Soil
List II: Characteristics or Minerals
1. High accumulation of un-decomposed organic matter
2. Rich in oxides of iron and aluminium due to intense leaching
3. Predominance of Kaolinite clay mineral
4. Swelling and shrinking property due to Montmorillonite
(A) P-4, Q-3, R-2, S-1
(B) P-4, Q-2, R-3, S-1
(C) P-3, Q-4, R-2, S-1
(D) P-3, Q-4, R-1, S-2

13. In the context of Uttar Pradesh, which of the following soil types is found immediately south of the Shivalik foothills, characterized by highly porous, coarse gravel and pebbles where streams often disappear underground?
(A) Terai soils
(B) Bhangar soils
(C) Bhabhar soils
(D) Khadar soils

14. Which specific local name is given to the black clayey soils found in the Bundelkhand and Mirzapur regions of Uttar Pradesh, known for their moisture retention capacity?
(A) Bhur
(B) Usar
(C) Reh
(D) Karail

15. The process of laterization, which leads to the formation of laterite soils, is characterized by which of the following phenomena?
(A) Leaching of silica and accumulation of iron and aluminium oxides
(B) Leaching of iron oxides and accumulation of silica and carbonates
(C) Leaching of organic matter and accumulation of calcium carbonate
(D) Leaching of heavy minerals and accumulation of soluble sodium salts

16. In the alluvial plains of Uttar Pradesh, what is the primary difference between Khadar and Bhangar soils?
(A) Khadar is older alluvium from ancient rivers, while Bhangar is newer alluvium deposited by ongoing annual floods.
(B) Khadar is newer alluvium deposited by floods, while Bhangar is older alluvium located on higher terraces.
(C) Khadar soils are heavily saline coastal deposits, while Bhangar soils represent highly acidic inland formations.
(D) Khadar soils are confined to the southern plateau, while Bhangar soils are restricted to the northern Terai belt.

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17. Which of the following is the first stage of water erosion, occurring when falling raindrops break down soil aggregates and detach soil particles?
(A) Rill erosion
(B) Splash erosion
(C) Sheet erosion
(D) Gully erosion

18. Consider the following statements regarding soil erosion control measures:
I. Contour bunding is a mechanical measure generally adopted in areas having a slope of up to 6 percent.
II. Grassed waterways are a biological measure primarily designed to safely dispose of excess runoff water.
III. Bench terracing is strictly an agronomic measure used on very flat lands to increase infiltration.
Which of the given combinations of statements is INCORRECT?
(A) I only
(B) III only
(C) I and II only

(D) II and III only

19. Which form of water erosion is often referred to as the "death of the farmer" because it removes a thin, uniform layer of the most fertile topsoil without being easily noticed?
(A) Gully erosion
(B) Slip erosion
(C) Sheet erosion
(D) Rill erosion

20. Select the correct sequence of water erosion stages from initial impact to advanced degradation.
(A) Rill erosion → Splash erosion → Sheet erosion → Gully erosion
(B) Splash erosion → Sheet erosion → Rill erosion → Gully erosion
(C) Sheet erosion → Splash erosion → Gully erosion → Rill erosion
(D) Splash erosion → Rill erosion → Sheet erosion → Gully erosion

21. In wind erosion, what percentage of total soil movement is typically caused by 'saltation' (bouncing of medium-sized soil particles)?
(A) 5 to 10 percent
(B) 15 to 25 percent
(C) 50 to 75 percent
(D) 90 to 95 percent

22. Contour bunding is a highly effective mechanical measure to check soil erosion and conserve moisture. For which of the following rainfall conditions is contour bunding most highly recommended?
(A) High rainfall areas (above 1500 mm)
(B) Low rainfall areas (less than 600 mm)
(C) Areas with severe waterlogging
(D) Riverbanks with severe gully erosion

23. Bench terracing is recommended for soil conservation in hilly areas. What is the typical land slope range for which bench terracing is practically adopted?
(A) 1 to 5 percent
(B) 6 to 15 percent
(C) 16 to 33 percent
(D) More than 50 percent

24. Which of the following cropping practices utilizes a dense vegetative cover crop specifically to protect the soil surface from the direct impact of raindrops and reduce runoff velocity?
(A) Mulch cropping with cowpea or moong
(B) Monocropping of sugarcane in drylands
(C) Clean cultivation with continuous tillage
(D) Deep ploughing during the monsoon season

25. Match the soil conservation measures in List I with their corresponding category or feature in List II and select the correct option.
List I: Soil Conservation Measures
P. Strip cropping
Q. Shelterbelts
R. Broad bed and furrow
S. Drop spillways
List II: Categories or Features
1. Agronomic measure against water erosion
2. Biological measure against wind erosion
3. Mechanical measure for safe gully runoff disposal
4. In-situ moisture conservation technique for heavy soils
(A) P-1, Q-2, R-4, S-3
(B) P-1, Q-4, R-2, S-3
(C) P-2, Q-1, R-3, S-4
(D) P-3, Q-2, R-4, S-1

26. What is the approximate average bulk density of a normal mineral soil containing optimal organic matter?
(A) 1.05 Mg/cubic meter
(B) 1.33 Mg/cubic meter
(C) 2.65 Mg/cubic meter
(D) 3.10 Mg/cubic meter

27. How does the formation of a hard plough pan just below the tillage depth primarily affect sugarcane crop production?
(A) It enhances topsoil water retention, significantly increasing crop yields and vegetative growth.
(B) It promotes rapid downward leaching of essential nitrogen and phosphorus nutrients into groundwater.
(C) It elevates overall subsoil temperature, drastically hastening early shoot borer pest infestations.
(D) It restricts deep root penetration, leading to poor anchorage and increased susceptibility to lodging.

28. In the context of soil water retention and irrigation management, at what atmospheric tension is water held at the Permanent Wilting Point (PWP)?
(A) 0.33 atmosphere
(B) 1 atmosphere
(C) 15 atmospheres

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synthetic auxins such as naphthalene acetic acid maintain structural integrity in abscission zones. This prevents hydrolytic enzyme activity from dissolving cell walls, thereby delaying tissue drop and securing higher fruit retention rates.

55. (B) Loss of turgor pressure in cells
Plant structural rigidity relies upon cellular turgor pressure, generated when vacuolar water pushes against rigid cell walls. Under severe soil water deficits, transpirational water loss exceeds root water absorption, depleting cellular moisture. As water leaves plant cells, internal hydrostatic pressure drops significantly, leading to flaccidity, drooping leaves, and visible stem wilting across affected crop canopies.

56. (C) Proline
Under osmotic stresses caused by drought or excessive soil salinity, plants synthesize and accumulate compatible organic solutes called osmoprotectants within their cytoplasm. Proline, a non-proteinogenic amino acid, acts as an essential cellular osmoprotectant. It lowers internal cell water potential to retain moisture, neutralizes reactive oxygen species, stabilizes cell membranes, and protects enzymes from denaturation.

57. (C) Assertion (A) is true but Reason (R) is false.
Drought stress triggers rapid biosynthesis and accumulation of abscisic acid within leaf tissues. Abscisic acid acts as a crucial stress signal, inducing potassium ion efflux from guard cells to cause rapid stomatal closure, which minimizes transpirational water loss. Therefore, elevated abscisic acid levels function to prevent dehydration rather than increasing transpiration or opening stomata.

58. (A) Heat Shock Proteins (HSPs)
High ambient temperatures induce thermal stress, threatening plant metabolic integrity by causing enzyme denaturation and protein misfolding. In response, plants synthesize specialized protective proteins known as Heat Shock Proteins. HSPs act as molecular chaperones, binding unfolded proteins to maintain structural stability, prevent cellular protein aggregation, and assist in refolding damaged enzymes during heat exposure.

59. (B) I, III, and IV
Freezing stress damages plant tissues through lethal intracellular ice crystal formation that disrupts cellular membranes. Tropical crops like sugarcane suffer chilling injury at low non-freezing temperatures, whereas elevated heat increases respiratory carbohydrate consumption. Sugarcane achieves optimal physiological growth within warm regimes of thirty to thirty-five degrees Celsius, maintaining optimal photosynthesis and vegetative development.

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60. (B) Reducing free water and increasing soluble sugars
Seedling hardening before field transplanting enhances physiological resilience to environmental stress. The process involves gradually withholding irrigation and exposing seedlings to lower temperatures. Physiologically, this reduces free cellular water while increasing solute concentrations, such as soluble sugars and proline. Consequently, cellular osmotic potential drops, reinforcing cell membranes against desiccation, chilling damage, and transplanting shock.

61. (A) Imbibition of water by the seed coat
Seed germination begins with imbibition, a physical process where dry seed coats absorb water through matrix potential forces. Imbibition causes dry seeds to swell, rehydrating desiccated cellular tissues and softening hard seed coats. This hydration activates metabolic enzymes, initiates cellular respiration, and drives subsequent physiological processes required for embryonic axis growth and seedling emergence.

62. (A) 2, 3, 4, 1
Seed germination follows a precise sequential physiological timeline. First, water imbibition rehydrates dry seed tissues, triggering metabolic reactivation. Next, plant hormones like gibberellins stimulate hydrolytic enzyme synthesis, such as alpha-amylase. These enzymes break down stored endosperm nutrients into simple sugars, translocating them to the embryo axis. Finally, cell elongation drives radicle emergence through seed coats.

63. (D) Chemical dormancy
Chemical dormancy occurs when endogenous chemical substances inside seed coats or embryonic tissues inhibit germination despite favorable environmental conditions. High

(B) Heavy, poorly drained black clay soils with high waterlogging and elevated salinity levels
(C) Deep, well-drained loam to clay-loam soils with neutral pH and adequate organic matter
(D) Highly acidic, highly leached laterite soils exhibiting very poor overall water retention

38. What is the optimal soil pH range recommended for maximizing nutrient uptake and cane yield in sugarcane?
(A) 4.5 to 5.5
(B) 5.5 to 6.5
(C) 6.5 to 7.5
(D) 8.0 to 9.0

39. Which of the following statements best describes the difference between soil fertility and soil productivity?
(A) Soil productivity is strictly a laboratory evaluation, whereas soil fertility represents the overall economic return and market yield of the harvested crop.
(B) Every fertile soil is inherently and highly productive under field conditions, irrespective of prevailing climatic factors or crop management constraints.
(C) Soil fertility refers exclusively to physical structure and soil depth, whereas soil productivity refers strictly to available chemical plant nutrients present.
(D) Soil fertility is the inherent capacity to supply plant nutrients, while soil productivity is the crop yield per unit area under specific management.

40. Consider the following statements regarding the biological properties of soil:
I. Soil organic matter is the primary energy source for heterotrophic soil microorganisms.
II. Bacteria represent the most abundant group of microbes in agricultural soils by number.
III. Mycorrhizal fungi form symbiotic associations with plant roots, primarily aiding in potassium absorption.
IV. Nitrogen fixation in soil can occur both symbiotically by Rhizobium and asymbiotically by Azotobacter.
Which of the given combinations of statements is correct?
(A) I, II and III only
(B) I, II and IV only
(C) II, III and IV only
(D) I, III and IV only

41. Which endophytic nitrogen-fixing bacteria is specifically known to colonize the interior tissues of sugarcane roots and stems, contributing significantly to its nitrogen requirement?
(A) Rhizobium leguminosarum
(B) Azospirillum brasilense
(C) Gluconacetobacter diazotrophicus
(D) Nitrobacter winogradskyi

42. In lighter, sandy soils of Uttar Pradesh, sugarcane crops are often highly susceptible to biological damage from which microscopic soil-dwelling organisms that cause characteristic root galls?
(A) Root-knot nematodes (Meloidogyne spp.)
(B) White grub larvae (Holotrichia species)
(C) Composting earthworms (Eisenia fetida)
(D) Soil actinomycetes (Streptomyces spp.)

43. By volume, what proportion of a well-aggregated loam soil at field capacity is occupied by soil air and soil water combined?
(A) 25 percent
(B) 40 percent
(C) 50 percent
(D) 75 percent

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44. Humus is a dark, complex, stable fraction of soil organic matter. Which of the following is an important chemical property of humus?
(A) It drastically lowers the water-holding capacity of the soil.
(B) It acts as a buffer against rapid changes in soil pH.
(C) It has a very low Cation Exchange Capacity (CEC).
(D) It promotes the formation of single-grained, loose soil structure.

45. Match the major soil zones of Uttar Pradesh in List I with their corresponding regions or districts in List II and select the correct option.
List I: Major Soil Zones
P. Bhabhar and Terai soils
Q. Alluvial plains (Khadar/Bhangar)
R. Vindhyan soils
S. Bundelkhand soils
List II: Regions or Districts
1. Mirzapur and Sonbhadra
2. Lakhimpur Kheri and Pilibhit
3. Jhansi, Jalaun, and Lalitpur
4. Kanpur, Lucknow, and Varanasi
(A) P-2, Q-4, R-1, S-3
(B) P-2, Q-1, R-4, S-3
(C) P-4, Q-2, R-1, S-3

(B) Montmorillonite
(C) Feldspar
(D) Mica (Muscovite)

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(D) 30 to 60 cm only

56. Consider the following statements regarding the mechanisms of wind erosion:
I. Suspension involves the movement of very fine dust particles over long distances high in the air.
II. Surface creep involves the rolling and sliding of larger soil particles along the ground surface.
III. Wind erosion is most severe in heavily vegetated, clayey soils of high rainfall regions.
Which of the given combinations of statements is correct?
(A) I and II only
(B) II and III only
(C) I and III only
(D) I, II and III

57. Earthworms improve the biological and physical properties of soil through burrowing and casting. Which specific term is used for the organic fertilizer produced by earthworm action on organic wastes?
(A) Green manure
(B) Farmyard manure
(C) Vermicompost
(D) Biogas slurry

58. Red soils in regions bordering Uttar Pradesh exhibit their characteristic reddish colour primarily due to the presence of:
(A) Ferric oxides formed by prolonged weathering processes
(B) High accumulation of undecomposed surface organic humus
(C) High concentration of calcium carbonate nodules in subsoil
(D) Dominance of swelling montmorillonite clay mineral groups

59. The highly clayey, moisture-retentive black soils of the Bundelkhand region of Uttar Pradesh are locally known by which two specific names?
(A) Khadar and Bhangar
(B) Bhur and Reh
(C) Bhabhar and Terai
(D) Mar and Kabar

60. Match the soil science terminology in List I with its correct definition in List II and select the correct option.
List I: Soil Science Terminology
P. Pedology
Q. Edaphology
R. Regolith
S. Solum
List II: Definitions
1. The study of soil from the standpoint of higher plants
2. The true soil comprising only the A and B horizons
3. The study of soil genesis, classification, and morphology
4. The unconsolidated debris overlaying hard bedrock
(A) P-3, Q-1, R-4, S-2
(B) P-1, Q-3, R-2, S-4
(C) P-3, Q-1, R-2, S-4
(D) P-4, Q-2, R-1, S-3

61. The concept of "Soil Catena" describes the variation in soil profile development primarily due to differences in which factor of soil formation?
(A) Climate
(B) Parent rock material
(C) Topography (relief)
(D) Organisms

62. In regions with very high rainfall and high temperatures, extreme leaching of basic cations from the soil profile occurs over time. This climatic factor primarily leads to the formation of which type of soil?
(A) Sodic soil
(B) Calcareous soil
(C) Saline soil
(D) Acidic soil

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63. Soil crusting after a heavy rainfall or irrigation is a significant problem affecting seedling emergence in many parts of Uttar Pradesh. Crusting is most severe in soils that are highly dominant in:
(A) Silt and fine sand with low organic matter
(B) Coarse sand and gravel fractions lacking fine silt
(C) Granular clay aggregates enriched with active humus
(D) Coarse pebbles, cobbles, and unweathered gravel bits

64. To effectively control wind erosion and protect sugarcane crops from hot winds (loo) in western UP, windbreaks and shelterbelts should ideally be planted in which alignment relative to the prevailing wind direction?

(D) P-2, Q-4, R-3, S-1

46. A soil textural class is defined by the relative proportions of which three primary soil separates?
(A) Gravel, sand, and silt
(B) Sand, clay, and organic matter
(C) Loam, silt, and clay
(D) Sand, silt, and clay

47. Among the following soil textural classes, which one generally possesses the highest total water-holding capacity, although not all the water is available to plants?
(A) Clay
(B) Sandy loam
(C) Loam
(D) Silt loam

48. Which soil textural class inherently exhibits the highest rate of infiltration and percolation of water?
(A) Silty clay
(B) Sandy soil
(C) Clay loam
(D) Peaty soil

49. Adequate soil aeration is crucial during the early stages of sugarcane growth. Poor soil aeration resulting from waterlogging during the tillering phase primarily leads to:
(A) Rapid acceleration of atmospheric nitrogen fixation and conversion into available nitrate ions.
(B) Accumulation of toxic reduced compounds like hydrogen sulphide, causing poor root growth and tillering.
(C) Enhanced root respiration rate accompanied by significantly deeper and robust lateral root growth.
(D) Extremely rapid aerobic decomposition of organic matter resulting in massive formation of humus.

50. Select the correct general order of major soil regions in Uttar Pradesh as one travels strictly from the northern border (Himalayan foothills) towards the southern plateau.
(A) Terai → Bhabhar → Alluvial Plains → Bundelkhand/Vindhyan
(B) Bhabhar → Terai → Alluvial Plains → Bundelkhand/Vindhyan
(C) Alluvial Plains → Terai → Bhabhar → Bundelkhand/Vindhyan
(D) Bhabhar → Alluvial Plains → Terai → Bundelkhand/Vindhyan

51. Read the given Assertion (A) and Reason (R) and choose the correct option.
Assertion (A): Deep ploughing or subsoiling every three to four years is highly recommended in sugarcane ratoon management.
Reason (R): Subsoiling breaks the compacted hardpan in the subsoil, thereby improving root penetration and water infiltration for the ratoon crop.
(A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
(B) Both Assertion (A) and Reason (R) are true but R is not the correct explanation of A.
(C) Assertion (A) is true but Reason (R) is false.
(D) Assertion (A) is false but Reason (R) is true.

52. Gypsum is used extensively in Uttar Pradesh to reclaim alkaline soils. What is the chemical formula of agricultural gypsum?
(A) $CaCO_3$
(B) CaO
(C) $MgSO_4.7H_2O$
(D) $CaSO_4.2H_2O$

53. In some calcareous soils of eastern Uttar Pradesh with high free calcium carbonate, sugarcane crops frequently show interveinal chlorosis on younger leaves. This is primarily an indicator of induced deficiency of which nutrient?
(A) Nitrogen
(B) Potassium
(C) Iron
(D) Molybdenum

54. Pressmud (or filter cake) is an important industrial byproduct used as an organic soil amendment in sugarcane farming. Which type of pressmud is specifically beneficial for reclaiming alkaline soils?
(A) Carbonation process pressmud
(B) Sulphitation pressmud
(C) Raw bagasse
(D) Molasses

55. For proper soil testing of a field meant for planting sugarcane, what is the standard recommended depth from which the soil sample should be collected to assess the nutrient status of the root zone?
(A) 0 to 5 cm only
(B) 0 to 15 cm and 15 to 30 cm
(C) 0 to 60 cm and 60 to 90 cm

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essential plant nutrients, improves soil structure, and enhances water-holding capacity.
(A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
(B) Both Assertion (A) and Reason (R) are true but R is not the correct explanation of A.
(C) Assertion (A) is true but Reason (R) is false.
(D) Assertion (A) is false but Reason (R) is true.

73. Heavy movement of loaded tractor-trolleys and machinery in sugarcane fields during harvest causes severe soil compaction. What is the primary negative consequence of this compaction on the subsequent ratoon crop?
(A) It drastically decreases bulk density values, rendering topsoil too loose for stable root anchorage.
(B) It greatly enhances the overall cation exchange capacity and nutrient retention of subsoil layers.
(C) It reduces total porosity and macro-pore space, severely restricting root penetration and aeration.
(D) It causes a sudden and steep drop in soil pH levels, inducing severe aluminum and manganese toxicity.

74. Which among the following is the most popular, fast-growing green manuring leguminous crop grown during the summer (Zaid) season in Uttar Pradesh to incorporate nitrogen and organic matter into the soil before planting autumn sugarcane?
(A) Dhaincha (Sesbania)
(B) Sorghum (Jowar)
(C) Pearl millet (Bajra)
(D) Maize (Makka)

75. In classical soil fertility evaluation, which of the following is considered an excellent 'indicator plant' for identifying phosphorus deficiency in soils?
(A) Sugarcane
(B) Cabbage
(C) Wheat
(D) Tomato

76. The mechanical analysis of soil separates particles based on their effective diameter. Arrange the following soil particles strictly in descending order of their size (from largest to smallest).
1. Silt
2. Fine Sand
3. Gravel
4. Clay

(A) 3, 2, 1, 4
(B) 3, 1, 2, 4
(C) 2, 3, 1, 4
(D) 4, 1, 2, 3

77. The Cation Exchange Capacity (CEC) of a soil is a direct indicator of its chemical fertility. What is the standard scientific unit used to express soil CEC?
(A) deciSiemens per metre of saturation extract (dS/m)
(B) milliequivalents per litre of soil solution (meq/L)
(C) centimoles of positive charge per kilogram of soil (cmol(p^+)/kg)
(D) parts per million of oven-dry soil mass (ppm)

78. Consider the following statements differentiating saline and sodic (alkali) soils:
I. Saline soils display white encrustations of salts on the surface, while sodic soils often appear dark or black due to dissolved organic matter.
II. Saline soils can be managed simply by leaching with good quality water, whereas sodic soils strictly require chemical amendments like gypsum before leaching.
III. Sodic soils have excellent physical structure and water infiltration rates compared to saline soils.
Which of the given combinations of statements is correct?
(A) I and II only
(B) II and III only
(C) I and III only
(D) I, II and III

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79. The fundamental parent material for most soils is derived from the weathering of underlying rocks. Which of the following is an example of a primary Igneous rock from which major agricultural soils like black soils are originally formed?
(A) Basalt
(B) Sandstone
(C) Limestone
(D) Marble

80. During the soil formation process, weathering of primary minerals produces secondary minerals. Which of the following is a classic example of a secondary mineral found in the clay fraction of soils?
(A) Quartz

9. (C) Actinomycetes
Actinomycetes are filament-forming soil organisms intermediate between bacteria and fungi that specialize in breaking down complex, resistant organic compounds such as chitin, cellulose, and lignin. During rain, these organisms release volatile organic compounds, predominantly geosmin, into the atmosphere. Geosmin is directly responsible for the distinct, earthy odor characteristic of dry soil immediately following the season's initial rainfall event.

10. (A) I and II only
Soil pH strongly influences plant nutrient availability. Phosphorus availability peaks near neutral pH values between six point five and seven point five, as it precipitates with iron and aluminium under acidic conditions and calcium under alkaline conditions. Micronutrients like iron, manganese, and zinc are highly soluble and available in strongly acidic soils, whereas molybdenum availability increases in alkaline conditions.

11. (B) A2 or E horizon
In a standard soil profile, the A2 or E horizon serves as the primary zone of maximum eluviation or leaching. Water percolating through this horizon carries downward fine clay particles, organic complexes, iron oxides, and aluminium oxides into lower depths. This continuous leaching leaves behind a lighter-colored, resistant mineral layer composed mainly of quartz and coarse resistant silicate minerals.

12. (A) P-4, Q-3, R-2, S-1
Black soils contain montmorillonite clay, which expands when wet and shrinks when dry, causing severe swelling and cracking. Red soils are dominated by non-expanding kaolinite clay. Laterite soils experience intense leaching under tropical conditions, accumulating iron and aluminium oxides. Peaty soils form in waterlogged, anaerobic environments where organic matter accumulates in large quantities without decomposing completely.

13. (C) Bhabhar soils
The Bhabhar belt lies directly south of the Shivalik foothills in northern Uttar Pradesh. It consists of coarse, unassorted sediments, gravels, cobbles, and porous subsoil deposited by fast-flowing mountain streams. Due to extreme porosity and high permeability, smaller rivers and streams frequently sink beneath the surface, flowing underground through these coarse deposits before re-emerging further south in the Terai region.

14. (D) Karail
Karail is the local name for deep, dark, clayey soils found in eastern parts of Uttar Pradesh, including regions near Mirzapur and Bundelkhand. These soils closely resemble central Indian black cotton soils, possessing fine clay texture, strong water-retention capacity, and high plasticity. They crack significantly upon drying and turn sticky when wet, demanding precise moisture management during cultivation.

15. (A) Leaching of silica and accumulation of iron and aluminium oxides
Laterization is a intense weathering process occurring under warm, humid tropical climates with alternating wet and dry seasons. Heavy rainfall severely leaches soluble bases and silica from the upper horizons of the soil profile. Consequently, resistant hydrated oxides of iron and aluminium accumulate in the topsoil, forming iron-rich, acidic, reddish laterite soils characterized by poor overall fertility.

16. (B) Khadar is newer alluvium deposited by floods, while Bhangar is older alluvium located on higher terraces.
Alluvial plains contain two distinct soil formations based on depositional history. Khadar represents low-lying, younger alluvial deposits situated adjacent to river channels that receive fresh silt during annual flood events, maintaining high natural fertility. In contrast, Bhangar consists of older alluvial deposits located on higher terraces above current flood levels, frequently containing calcareous concentrations known locally as kankar.

17. (B) Splash erosion
Splash erosion represents the initial phase of water-induced soil erosion. It occurs when falling raindrops hit bare soil with high kinetic energy, shattering soil aggregates into fine particles and detaching them from the soil matrix. These detached particles are splashed into the air and can seal surface pores, thereby reducing water infiltration and initiating subsequent surface runoff processes.

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ANSWERS

1. (B) 45 percent mineral matter and 5 percent organic matter
Ideal agricultural soil consists of approximately fifty percent solid space and fifty percent pore space by volume. The solid portion is composed of forty-five percent mineral matter derived from weathered rocks and five percent organic matter from decomposed plant and animal tissues. The remaining pore space is equally divided between air and water, each occupying around twenty-five percent.

2. (A) Soil texture
Soil texture refers to the relative proportion of sand, silt, and clay particles in a soil mass. It is a fundamental physical property determined primarily by parent material weathering over geologic time. Unlike structure, bulk density, or porosity, soil texture cannot be easily altered or modified through standard agricultural field practices such as tillage, cultivation, or compaction.

3. (A) Less than 0.002 mm
According to the International Society of Soil Science system, soil particles are categorized based on their equivalent diameter. Sand particles range from two millimeters down to two-hundredths of a millimeter, while silt particles range from two-hundredths to two-thousandths of a millimeter. Clay particles represent the finest mineral fraction, having an effective equivalent diameter of less than two-thousandths of a millimeter.

4. (D) Crumb structure
Crumb structure is a highly porous subtype of granular structure where soil aggregates are soft, small, and roughly spherical. This structure offers optimal balance between macro-pores and micro-pores, providing superior aeration, infiltration, and root expansion. It facilitates uniform seed germination and robust root establishment for deep-rooted crops like sugarcane, preventing root restriction while ensuring sufficient moisture retentivity.

5. (C) Climate
Soil formation relies on active and passive factors as defined by Dokuchaev and Jenny. Active factors supply energy and directly drive chemical, physical, and biological weathering processes, with climate and biosphere being the primary active agents. Conversely, parent material, topography, and time serve as passive factors, acting as the base or defining the conditions under which active factors operate.

6. (B) Tint
The Munsell color system standardizes soil color description using three essential dimensions: hue, value, and chroma. Hue represents the dominant spectral wavelength or color, such as red or yellow. Value indicates the relative lightness or darkness of the color along a grey scale. Chroma reflects the purity or relative strength of the spectral color, whereas tint is not utilized.

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7. (A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
Clay particles and soil organic matter possess extensive surface areas dominated by negative charges resulting from isomorphous substitution and functional group ionization. These negative sites attract and reversibly hold positively charged nutrient ions like calcium, magnesium, and potassium. Consequently, clay-rich soils exhibit significantly higher cation exchange capacities than coarse-textured sandy soils, which lack substantial surface charge and colloidal content.

8. (B) 10:1 to 12:1
Well-decomposed soil organic matter or humus reaches a stable state with a carbon to nitrogen ratio typically ranging between ten to one and twelve to one in arable Indian soils. This balanced ratio signifies an equilibrium between microbial decomposition and nitrogen immobilization, ensuring steady nutrient mineralization and maintaining overall soil fertility necessary for productive agricultural crop development and biological stability.

(A) Parallel aligned to the prevailing regional wind direction
(B) Perpendicular (at right angles) to prevailing wind direction
(C) Concentric circular rows established around the field center
(D) Exclusively aligned along the southern field boundaries

65. Agronomic measures for soil and water conservation (like contour farming, mulching, and cover cropping) are generally recommended and most effective on lands having a mild slope of less than:
(A) 2 percent
(B) 10 percent
(C) 16 percent
(D) 25 percent

66. Intensive cultivation of crops in the Terai soils of Uttar Pradesh frequently leads to the deficiency of which specific micronutrient, historically famous for causing the 'Khaira' disease in rice, but also impacting sugarcane yield?
(A) Zinc
(B) Boron
(C) Molybdenum
(D) Copper

67. If a soil test report shows a soil pH of 9.2 and an Exchangeable Sodium Percentage (ESP) of 25, the soil will most likely exhibit severe deficiency of which set of nutrients?
(A) Sodium and Chloride
(B) Molybdenum and Magnesium
(C) Zinc, Iron, and Manganese
(D) Calcium and Sulphur

68. Consider the following statements regarding the standard recommendations given under a Soil Health Card:
I. It recommends exact doses of chemical fertilizers needed for specific crops.
II. It suggests appropriate organic manures and bio-fertilizers.
III. It provides requirements for soil amendments like gypsum or lime based on pH.
IV. It mandates the compulsory purchase of specific branded fertilizers by the farmer.
Which of the given combinations of statements is correct?
(A) I, II and IV only
(B) II, III and IV only
(C) I, II and III only
(D) I, III and IV only

69. When reclaiming highly sodic (alkali) soils using gypsum, why is providing a provision for good artificial drainage absolutely essential?
(A) To prevent the newly added chemical gypsum amendment from rapidly evaporating into the air.
(B) To promote the continuous buildup and accumulation of insoluble calcium carbonate in topsoil.
(C) To allow the replaced soluble sodium sulphate salt to be leached down out of the root zone.
(D) To drastically reduce the overall population and activity of harmful soil-borne microflora.

70. Prolonged waterlogging in sugarcane fields leads to a sharp decrease in the oxidation-reduction (redox) potential of the soil. What chemical transformation occurs as a direct result of this reduced condition?
(A) Nitrate nitrogen is rapidly oxidized into highly toxic nitrite forms.
(B) Soluble manganese and iron are reduced to toxic forms (MN_2^+ and Fe^{2+}).
(C) Soil humus is rapidly mineralized into gaseous carbon dioxide molecules.
(D) Ammonium nitrogen is converted into usable nitrate ions almost instantly.

71. The cultural practice of 'earthing up' (Mitti chadhana) in sugarcane cultivation primarily serves which of the following soil-related functions?
(A) It significantly increases topsoil salinity levels by drawing soluble salts upwards through capillary action.
(B) It drastically lowers the overall C:N ratio of soil organic matter by accelerating nitrogen losses.
(C) It accelerates sheet erosion processes by loosening the topsoil excessively prior to severe rain events.
(D) It provides mechanical support to prevent lodging and improves drainage and aeration in root zones.

72. Read the given Assertion (A) and Reason (R) and choose the correct option.
Assertion (A): Incorporation of sugarcane trash and crop residues back into the soil improves long-term crop productivity.
Reason (R): Organic matter decomposition adds

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18. (B) III only
Soil conservation requires tailored engineering and biological practices based on topography. Contour bunding is a mechanical practice effective on gentle slopes up to six percent to detain surface runoff. Grassed waterways safely carry runoff away using vegetation. Bench terracing is an intensive engineering measure applied on steep slopes ranging from sixteen to thirty-three percent, rather than on flat lands.

19. (C) Sheet erosion
Sheet erosion is the uniform removal of thin layers of fertile topsoil over broad areas by shallow surface runoff. Because it progresses gradually without forming prominent channels or obvious physical scars, farmers often fail to notice the continuous loss of nutrient-rich soil. Consequently, this insidious destruction of land productivity earns sheet erosion the description of being the farmer's silent enemy.

20. (B) Splash erosion → Sheet erosion → Rill erosion → Gully erosion
Water erosion follows a progressive sequence of detachment and transport mechanisms. Impacting raindrops first initiate splash erosion by dislodging soil aggregates. Accumulated surface runoff then flows evenly, causing thin sheet erosion. As runoff concentrates into tiny, visible channels, rill erosion develops. Eventually, enlarging rills coalesce into deep, un-crossable channels known as gully erosion, representing advanced land degradation.

21. (C) 50 to 75 percent
Wind erosion moves soil through three distinct mechanisms based on particle diameter: suspension, saltation, and surface creep. Saltation involves medium-sized soil particles ranging from one-tenth to one-half millimeter in diameter bouncing across the soil surface in short hops. Saltation accounts for fifty to seventy-five percent of total wind-driven soil movement, driving the detachment and movement of other particles.

22. (B) Low rainfall areas (less than 600 mm)
Contour bunding involves constructing narrow earthen embankments along land contours to break slope length, intercept surface runoff, and promote in-situ rainwater infiltration. This mechanical practice is specifically suited for permeable soils in low rainfall regions receiving under six hundred millimeters annually. In high rainfall areas, contour bunding can cause waterlogging, impoundment problems, and eventual structural bund failure.

23. (C) 16 to 33 percent
Bench terracing transforms steep sloping hillside land into a series of level or nearly level step-like platforms separated by vertical retaining walls or vegetated risers. This mechanical measure is practically adopted on agricultural slopes ranging between sixteen and thirty-three percent. It effectively reduces runoff velocity, prevents soil erosion, and enables sustained arable crop cultivation on steep terrain.

24. (A) Mulch cropping with cowpea or moong
Mulch cropping involves growing fast-growing, close-growing leguminous cover crops like cowpea or green gram that quickly cover the soil surface. The canopy intercepts falling raindrops, absorbing kinetic energy to prevent particle detachment and surface sealing. Furthermore, the vegetative mat reduces surface runoff velocity, improves infiltration, retards evaporation losses, and protects soil structure from degradation during heavy rainfall events.

25. (A) P-1, Q-2, R-4, S-3
Strip cropping arranges alternating dense and row crops across slopes as an agronomic water conservation measure. Shelterbelts are linear tree plantings acting as biological wind barriers. Broad bed and furrow systems manage surface water and retain in-situ moisture in heavy clay soils. Drop spillways are engineered hydraulic structures designed to control gradient and safely discharge gully runoff water.

26. (B) 1.33 Mg/cubic meter
Bulk density represents the dry mass of soil per unit total volume, including both solids and pore spaces. A normal, well-aggregated mineral soil containing balanced sand, silt, clay, and organic matter typically possesses a bulk density of approximately one point three three megagrams per cubic meter. Higher values indicate severe compaction, whereas lower values indicate abundant organic matter.

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27. (D) It restricts deep root penetration, leading to poor anchorage and increased susceptibility to lodging.
Continuous shallow tillage creates a compacted subsoil layer or plough pan directly below the cultivated zone. This impenetrable hardpan severely restricts root growth, preventing sugarcane roots from accessing deeper moisture and nutrient reserves. Consequently, the crop develops shallow root systems, resulting in poor physical anchorage, restricted nutrient uptake, heightened drought susceptibility, and increased risk of plant lodging during storms.

28. (C) 15 atmospheres
Permanent Wilting Point represents the soil moisture content at which plants can no longer extract water rapidly enough to meet transpirational demands, causing permanent wilting. At this stage, soil water is held tightly within tiny micropores and as thin films around soil particles under a matric suction or tension equal to fifteen atmospheres, rendering it unavailable for normal plant uptake.

29. (A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
Coarse-textured sandy soils inherently exhibit high macroporosity, rapid drainage, and poor moisture retention. Incorporating bulky organic amendments like farmyard manure or pressmud adds humified organic matter that binds individual sand grains into stable micro-aggregates. This improves overall soil structure, creates water-retaining micro-pores, and leverages organic matter's high surface area to substantially enhance total water-holding capacity.

30. (C) 28°C to 32°C
Soil temperature significantly influences metabolic activity, enzyme function, and bud sprout initiation during sugarcane propagation. The optimum soil temperature range for rapid, uniform germination of sugarcane setts is twenty-eight to thirty-two degrees Celsius. Temperatures below twenty degrees slow enzymatic processes and delay sprouting, whereas temperatures exceeding thirty-five degrees can cause heat stress and sett desiccation.

31. (A) EC $>$ 4 dS/m, ESP $<$ 15, pH $<$ 8.5
Saline soils contain high concentrations of neutral soluble salts like chlorides and sulphates of sodium, calcium, and magnesium. According to standard diagnostic criteria, saline soils exhibit an electrical conductivity of saturation extract exceeding four deciSiemens per metre, an exchangeable sodium percentage below fifteen, and a soil pH below eight point five, keeping soil particles well aggregated.

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32. (B) Deflocculation of soil colloids caused by excess exchangeable sodium on the clay complex.
Alkali or sodic soils contain excessive exchangeable sodium on clay particles, exceeding an exchangeable sodium percentage of fifteen. Sodium ions possess a large hydrated radius and low valence, which weakens electrostatic attraction between clay particles. This causes severe deflocculation or dispersion of soil aggregates, destroying pore structure, sealing surface pores, drastically reducing water infiltration, and impairing root aeration.

33. (B) Application of mineral Gypsum (Calcium sulphate dihydrate)
Reclaiming problematic alkali or sodic soils requires replacing excess exchangeable sodium with calcium ions on the colloidal exchange complex. Mineral gypsum, chemically defined as calcium sulphate dihydrate, supplies soluble calcium. The added calcium displaces adsorbed sodium into soil solution as sodium sulphate, which is subsequently leached below the root zone through proper irrigation and drainage practices.

34. (B) I and II only
Reclaiming sodic soils requires replacing exchangeable sodium with calcium using amendments like gypsum, followed by leaching with clean water to wash displaced sodium salts below root zones. Incorporating green manure crops like Dhaincha adds organic acids, lowers pH, and improves permeability. However, basic materials like quicklime add excess calcium hydroxide, which is ineffective and unsuitable for reclaiming alkaline soils.

35. (C) 12 parameters
The Soil Health Card scheme systematically evaluates twelve fundamental parameters to assess overall soil fertility. These include physical parameters like electrical conductivity, chemical properties such as soil pH and organic carbon, macro-nutrients including nitrogen, phosphorus, and potassium, secondary nutrients like sulphur,

and micro-nutrients including zinc, iron, copper, manganese, and boron, aiding targeted nutrient management.

36. (D) Electrical Conductivity (EC)
Electrical conductivity measures the capacity of a soil solution to conduct an electric current, directly correlating with total soluble salt concentration. In soil health evaluation, electrical conductivity serves as the critical diagnostic parameter for determining salinity levels. Higher conductivity values indicate excessive salt accumulation, which raises osmotic pressure, restricts water uptake by roots, and impairs normal crop development.

37. (C) Deep, well-drained loam to clay-loam soils with neutral pH and adequate organic matter
Sugarcane is a long-duration, high-yielding crop requiring robust physical support, continuous moisture, and abundant nutrient availability. Deep, well-drained loam to clay-loam soils provide ideal root anchorage, balanced air-water relations, and high nutrient retention. A neutral pH ensures optimal nutrient availability, while adequate organic matter supports active soil microbial populations and maintains desirable soil structure throughout the season.

38. (C) 6.5 to 7.5
Sugarcane grows best in neutral to slightly acidic soils. A pH range between six point five and seven point five provides maximum availability of essential macro-nutrients and micro-nutrients without causing toxicities. Within this range, root development is uninhibited, microbial mineralisation proceeds efficiently, and applied chemical fertilizers are effectively absorbed, ensuring optimal cane yields and high juice quality.

39. (D) Soil fertility is the inherent capacity to supply plant nutrients, while soil productivity is the crop yield per unit area under specific management.
Soil fertility denotes the inherent capacity of soil to supply essential plant nutrients in balanced amounts and suitable forms for growth. Soil productivity represents the actual yield performance or economic output per unit area under specific climatic conditions and management practices. Highly fertile soils may not be productive if limited by poor drainage, pests, severe drought, or adverse climate.

40. (B) I, II and IV only
Soil organic matter acts as the key carbon and energy source for heterotrophic soil microbes. Bacteria are the most numerous microorganisms in agricultural soils. Biological nitrogen fixation occurs symbiotically via Rhizobium in legumes and asymbiotically via Azotobacter in soil. However, mycorrhizal fungi form symbiotic associations with roots primarily to enhance phosphorus absorption, rather than potassium uptake.

41. (C) Gluconacetobacter diazotrophicus
Gluconacetobacter diazotrophicus is an endophytic nitrogen-fixing bacterium that internally colonizes stems, roots, and leaves of sugarcane plants. Operating inside plant tissues rich in sucrose, it fixes atmospheric nitrogen directly into forms usable by the host plant. This endophytic association contributes significantly to sugarcane nitrogen nutrition, reducing dependency on chemical nitrogenous fertilizer applications under sustainable farming systems.

42. (A) Root-knot nematodes (Meloidogyne spp.)
In coarse-textured sandy soils, root-knot nematodes are major soil-borne parasites affecting sugarcane. Juveniles penetrate young root tips and establish permanent feeding sites, inducing gall or knot formation on root systems. Affected roots show reduced water and nutrient absorption capacity, leading to stunted shoot growth, leaf chlorosis, severe moisture stress, and significant reduction in overall sugarcane productivity.

43. (C) 50 percent
A well-structured loam soil at ideal field capacity consists of approximately fifty percent solid matrix and fifty percent total pore space by volume. Under field capacity conditions, half of the total pore space is filled with soil water held in micro-pores, while the remaining half contains soil air occupying macro-pores, ensuring balanced aeration and moisture supply.

44. (B) It acts as a buffer against rapid changes in soil pH.
Humus is a dark, complex colloidal substance formed through advanced organic matter decomposition. It possesses abundant carboxyl and phenolic functional groups that can donate or accept hydrogen ions depending on soil solution conditions. Consequently, humus acts

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(B) Molybdenum
(C) Zinc
(D) Copper

30. To assess the nutritional status of crops via leaf analysis, the diagnostic tool DRIS is widely used. What does DRIS stand for?
(A) Diagnosis and Recommendation Integrated System
(B) Direct Recording of Important Substances
(C) Diagnostic Recording and Inference System
(D) Dual Ratio Indication System

31. The maximum availability of phosphorus to plants generally occurs within which soil pH range?
(A) 4.5 to 5.5
(B) 6.5 to 7.5
(C) 8.0 to 9.0
(D) 3.0 to 4.5

32. Unlike most other micronutrients, the availability of which of the following elements increases as the soil becomes more alkaline (higher pH)?
(A) Iron
(B) Zinc
(C) Manganese
(D) Molybdenum

33. The continuous application of only nitrogenous fertilisers like urea over several years without adding organic matter or complex fertilisers is most likely to cause which problem in the soil?
(A) A rapid and sustained increase in overall soil porosity and aeration
(B) A severe build-up of toxic heavy metals and micronutrient toxicity
(C) Yield decline from secondary and micronutrient deficiencies
(D) A permanent structural conversion of soil into a sodic state

34. Match List I with List II to select the correct answer.
List I: Nutrient
P. Zinc
Q. Boron
R. Iron
S. Phosphorus
List II: Indicator Crop
1. Sugarcane / Sorghum
2. Maize / Paddy
3. Tomato / Rapeseed
4. Sunflower
(A) P-2, Q-4, R-1, S-3
(B) P-4, Q-2, R-3, S-1
(C) P-2, Q-1, R-4, S-3
(D) P-1, Q-3, R-2, S-4

35. Consider the following statements regarding the availability of nutrients in problem soils:
I. In highly acidic soils, the toxicity of aluminium and iron often inhibits plant growth.
II. Saline soils generally exhibit poor nitrogen availability due to suppressed microbial activity.
III. The availability of molybdenum is severely restricted in highly alkaline Usar soils.
Which of the above statement(s) is/are correct?
(A) I and II only
(B) II and III only
(C) I and III only
(D) I, II and III

36. Agricultural gypsum (CaSO4·2H2O) is extensively used in Uttar Pradesh to reclaim sodic (alkaline) soils. Besides reclaiming the soil, gypsum serves as a direct source of which two essential plant nutrients?
(A) Nitrogen and Calcium
(B) Calcium and Sulphur
(C) Phosphorus and Magnesium
(D) Potassium and Sulphur

37. When urea is surface-applied to high pH (alkaline) soils under warm conditions without immediate incorporation, a significant amount of nitrogen is lost to the atmosphere through which process?
(A) Leaching
(B) Denitrification
(C) Volatilisation
(D) Nitrification

38. A sugarcane field exhibits prominent zinc deficiency symptoms. The standard recommendation for immediate foliar correction in a standing crop involves spraying an aqueous solution of:
(A) 2.0% Zinc Sulphate solution applied to foliage
(B) 0.5% Zinc Sulphate with 0.25% slaked lime
(C) 5.0% Zinc Sulphate mixed with 2.0% Urea solution
(D) 0.1% Zinc Chelate sprayed without additives

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53. (C) Iron
Calcareous soils contain high concentrations of free calcium carbonate, maintaining an alkaline pH environment. High bicarbonate levels and elevated pH render iron insoluble by converting it into unavailable ferric oxides. Sugarcane grown in such soils develops lime-induced iron chlorosis, characterized by distinct interveinal yellowing on young expanding leaves, as iron is immobile within plant tissues.

54. (B) Sulphitation pressmud
Pressmud is a sugar factory byproduct rich in organic carbon and nutrients. Sulphitation pressmud is produced using sulphur dioxide during juice clarification, resulting in an acidic reaction with significant sulphate content. This acidic nature makes sulphitation pressmud particularly effective as an organic soil amendment for reclaiming alkaline soils, neutralising excess alkalinity while improving soil physical structure and microbial activity.

55. (B) 0 to 15 cm and 15 to 30 cm
Proper evaluation of soil fertility for deep-rooted crops like sugarcane requires sampling the primary root zone. Standard soil testing guidelines mandate collecting representative samples from dual depth intervals: zero to fifteen centimeters representing the topsoil layer, and fifteen to thirty centimeters representing upper subsoil conditions, ensuring accurate recommendations for major and micronutrient applications.

56. (A) I and II only
Wind erosion moves soil via three mechanisms: saltation, suspension, and surface creep. Suspension transports microscopic fine particles high into the air across vast distances. Surface creep involves larger soil grains rolling along the ground surface driven by wind and saltation impacts. Wind erosion is most severe in dry, sparse, sandy regions rather than moist, heavily vegetated clay soils.

57. (C) Vermicompost
Vermicompost is a high-quality organic fertilizer produced through the joint action of earthworms and microorganisms breaking down organic waste materials. Earthworms ingest organic matter, processing it through their digestive tracts to excrete nutrient-rich casts. This dark, granular compost contains readily available plant nutrients, beneficial microflora, growth hormones, and humic substances that significantly improve soil fertility and physical structure.

58. (A) Ferric oxides formed by prolonged weathering processes
Red soils develop through prolonged sub-aerial weathering of crystalline metamorphic and igneous rocks under warm, temperate climates. Their characteristic reddish color is directly attributed to high concentrations and widespread diffusion of iron oxides, primarily hematite and hydrated ferric oxides, coating soil particles. These soils are generally well-drained, porous, acidic to neutral, and low in organic matter content.

59. (D) Mar and Kabar
The southern Bundelkhand region features dark, fine-textured clayey soils locally classified into two primary categories: Mar and Kabar. Mar is a deep, dark greyish-black clay soil rich in organic matter and calcium, highly retentive of moisture. Kabar is a dark clay soil with high stickiness and cracking behavior, presenting management challenges when moisture conditions deviate from optimum levels.

60. (A) P-3, Q-1, R-4, S-2
Pedology examines soil origin, formation, classification, and morphology as natural bodies. Edaphology studies soil in relation to plant growth and crop production. Regolith refers to the un-consolidated layer of weathered rock material resting above unweathered bedrock. Solum represents the true, active soil profile consisting strictly of the A and B horizons developed through pedogenic processes.

61. (C) Topography (relief)
A soil catena refers to a sequence of different soil profiles occurring down a slope, derived from similar parent material under uniform climatic conditions. The variation in soil properties along a catena is driven primarily by topography and relief. Slope position influences surface runoff, water drainage, erosion rates, subsurface leaching, and organic matter accumulation from hilltop to valley bottom.

62. (D) Acidic soil
High rainfall combined with high temperatures accelerates mineral weathering and water

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igneous or metamorphic rock crystallization. Weathering transforms primary minerals into secondary minerals at earth surface conditions. Montmorillonite is a classic two-to-one expanding secondary clay mineral synthesized during weathering in alkaline, base-rich environments. It confers high cation exchange capacity, pronounced swelling-shrinking properties, and high water retention to clay soils.

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developing crop stalks. This cultural operation creates sturdy ridges that provide physical mechanical support to tall canes, drastically reducing crop lodging during high winds. Additionally, it creates furrows that improve field drainage, promote root zone aeration, and suppress late-emerging weed growth within crop rows.

72. (A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
Incorporating sugarcane trash and crop residues into field soils enhances long-term soil productivity. As soil microbes decompose this organic residue, essential plant nutrients like nitrogen, phosphorus, and potassium are gradually mineralized. Furthermore, organic decomposition yields humic substances that stabilize soil aggregates, increase total water retention capacity, improve aeration, and sustain beneficial soil biological activity.

73. (C) It reduces total porosity and macro-pore space, severely restricting root penetration and aeration.
Heavy machinery traffic during sugarcane harvesting compresses moist topsoil, drastically increasing bulk density and destroying structural aggregates. Soil compaction severely reduces total porosity, particularly eliminating large macro-pores responsible for water movement and root zone gas exchange. Reduced macroporosity restricts root penetration, impairs aeration, impedes water infiltration, and hinders initial bud sprouting and shoot establishment in subsequent ratoon crops.

74. (A) Dhaincha (Sesbania)
Dhaincha is a fast-growing, flood-tolerant leguminous crop widely cultivated during the summer season as green manure in Uttar Pradesh. It produces abundant succulent biomass within forty-five to fifty days and fixes substantial atmospheric nitrogen via root nodule symbiosis. Incorporating Dhaincha prior to autumn sugarcane planting improves organic matter content, soil structure, and total nitrogen availability.

75. (D) Tomato
Indicator plants display distinct visual deficiency symptoms when specific nutrients fall below threshold levels in soil. Tomato plants serve as an excellent indicator crop for phosphorus deficiency. When grown in phosphorus-deficient soils, tomato leaves and stems rapidly develop intense reddish-purple pigmentation caused by anthocyanin accumulation, providing a clear visual diagnostic signal of low soil phosphorus status.

76. (A) 3, 2, 1, 4
Soil mechanical analysis classifies particles by physical size. Gravel is largest, measuring over two millimeters. Fine sand measures between zero point two and zero point zero two millimeters. Silt ranges from zero point zero two to zero point zero zero two millimeters, while clay is smallest, measuring below zero point zero zero two millimeters in diameter.

77. (C) centimoles of positive charge per kilogram of soil ($cmol(p^+)/kg$)
Cation Exchange Capacity measures the total quantity of exchangeable cations that a soil can retain on its negatively charged colloidal surfaces. In modern scientific soil literature and standard International System of Units, Cation Exchange Capacity is expressed in centimoles of positive charge per kilogram of dry soil, replacing the older traditional unit of milliequivalents per hundred grams of soil.

78. (A) I and II only
Saline soils feature white surface salt crusts caused by soluble neutral salts, whereas sodic soils develop dark surfaces due to dissolved, dispersed organic matter. Saline soils are easily reclaimed by leaching with good water, while sodic soils require chemical amendments like gypsum to replace sodium before leaching. Sodic soils exhibit poor structure and low permeability due to colloid dispersion.

79. (A) Basalt
Basalt is a dark-colored, fine-grained, extrusive igneous rock rich in calcium, magnesium, and iron silicates. Basalt acts as the foundational parent rock for major agricultural soils, particularly black cotton soils or Vertisols. Through chemical and physical weathering over geological periods, basalt breaks down to produce clay-rich soils dominated by expanding smectite minerals with high natural fertility and water retention.

80. (B) Montmorillonite
Primary minerals like quartz, feldspar, and mica form under high temperatures during

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S. Calcium

List II: Key Function / Component

1. Root development and energy transfer
2. Structural component of middle lamella (cell wall)
3. Disease resistance and water balance
4. Major constituent of proteins and chlorophyll

(A) P-4, Q-1, R-3, S-2
(B) P-1, Q-4, R-2, S-3
(C) P-4, Q-2, R-1, S-3
(D) P-3, Q-1, R-4, S-2

11. Magnesium is an indispensable secondary nutrient for plants because it acts as the central atom in the molecular structure of:
(A) Auxin
(B) Chlorophyll
(C) ATP
(D) Cellulose

12. Which micronutrient is directly involved in the synthesis of the amino acid tryptophan, a precursor to the plant growth hormone auxin?
(A) Iron
(B) Zinc
(C) Boron
(D) Molybdenum

13. The element crucial for pollen tube germination, cell wall synthesis, and the translocation of sugars across plant membranes is:
(A) Boron
(B) Iron
(C) Manganese
(D) Copper

14. Consider the following statements regarding secondary nutrients:
I. Calcium enhances cell division and structural integrity.
II. Magnesium is exclusively required for root nodule formation in legumes and has no role in cereals.
III. Sulphur is essential for the synthesis of sulphur-containing amino acids like cystine and methionine.

Which of the above statement(s) is/are correct?
(A) I and II only
(B) I and III only
(C) II and III only
(D) I, II and III

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15. The visual deficiency symptoms of sulphur typically manifest first on which part of the plant?
(A) The older, lower leaves of the plant
(B) The active growing tips of roots
(C) The central stem internode sections
(D) The newer, younger leaves at top

16. In sugarcane cultivation, the optimal application of sulphur is considered highly beneficial primarily because it:
(A) Promotes higher tillering rates during early vegetative development
(B) Effectively suppresses infestations of early shoot borer pests
(C) Enhances juice quality and prevents scale during processing
(D) Directly accelerates internodal elongation throughout growth

17. Interveinal chlorosis on newly emerging leaves, where the leaf web turns pale yellow but the veins remain distinctly green, is the classic visual symptom of which nutrient deficiency?
(A) Potassium
(B) Iron
(C) Nitrogen
(D) Phosphorus

18. Arrange the following standard steps of scientific soil testing for nutrient diagnosis in the correct sequential order:
1. Grinding and sieving the sample
2. Air drying the sample in the shade
3. Chemical extraction and analysis in the laboratory
4. Collection of composite soil sample from the field

(A) 4, 1, 2, 3
(B) 4, 2, 1, 3
(C) 2, 4, 1, 3
(D) 4, 2, 3, 1

19. The widespread physiological disorder in paddy known as 'Khaira disease', which causes brown or rusty spots on older leaves, is caused by the deficiency of:
(A) Zinc
(B) Iron
(C) Boron
(D) Copper

CHAPTER 13

Soil Nutrients and Deficiency Disorders

1. Who among the following scientists proposed the 'criteria of essentiality' for plant nutrients?
(A) Justus von Liebig
(B) Arnon and Stout
(C) E. Truog
(D) D.I. Arnon and Hoagland

2. How many elements are currently recognised as fundamentally essential for the growth and development of most higher plants?
(A) 14
(B) 16
(C) 17
(D) 21

3. Which of the following primary macro nutrients is strictly required for the formation of amino acids, proteins, and chlorophyll in plants?
(A) Nitrogen
(B) Phosphorus
(C) Potassium
(D) Calcium

4. Phosphorus plays a critical role in plant metabolism primarily as:
(A) A regulator of stomatal opening and closing in epidermal cells
(B) A structural component of the middle lamella in plant cell walls
(C) An essential constituent of energy-rich ATP and ADP molecules
(D) An enzymatic catalyst in the complex synthesis of plant lignin

5. The essential nutrient most closely associated with maintaining cell turgor, water balance, and stomatal regulation in crops, including sugarcane, is:
(A) Potassium
(B) Calcium
(C) Sulphur
(D) Nitrogen

6. Given below are two statements: one is labelled as Assertion (A) and the other as Reason (R).
Assertion (A): The deficiency symptoms of nitrogen first appear on the older, lower leaves of the plant.
Reason (R): Nitrogen is highly mobile within the plant system and moves from older tissues to actively growing younger parts when in short supply.
(A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
(B) Both Assertion (A) and Reason (R) are true but R is not the correct explanation of A.
(C) Assertion (A) is true but Reason (R) is false.
(D) Assertion (A) is false but Reason (R) is true.

7. Under standard sugarcane cultivation practices in Uttar Pradesh, the application of which nutrient must be restricted during the late growth stages to prevent a decline in sucrose accumulation and juice quality?
(A) Phosphorus
(B) Nitrogen
(C) Potassium
(D) Zinc

8. A farmer is advised to apply 150 kg of Nitrogen per hectare to a sugarcane crop. If Urea (46% N) is the sole nitrogenous fertiliser used, approximately how much Urea is required per hectare?
(A) 250 kg
(B) 326 kg
(C) 150 kg
(D) 460 kg

9. Which of the following groups of elements is categorised as 'Secondary Nutrients' in agricultural science?
(A) Nitrogen, Phosphorus, Potassium
(B) Zinc, Boron, Iron
(C) Manganese, Copper, Molybdenum
(D) Calcium, Magnesium, Sulphur

10. Match List I with List II to select the correct answer.
List I: Nutrient
P. Nitrogen
Q. Phosphorus
R. Potassium

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percolation through the soil profile. This intensive leaching washes basic cations such as calcium, magnesium, potassium, and sodium down beyond the root zone. Consequently, hydrogen and aluminium cations dominate the exchange complex, increasing soil acidity and eventually forming strongly acidic soils low in base saturation.

63. (A) Silt and fine sand with low organic matter
Soil crusting occurs when heavy rainfall or irrigation breaks unstable surface aggregates, dispersing fine particles that seal surface pores. Upon drying, this dispersed layer hardens into a dense structural crust. This physical phenomenon is most severe in soils rich in silt and fine sand that lack adequate organic matter, significantly impeding emerging crop seedlings and reducing root aeration.

64. (B) Perpendicular (at right angles) to prevailing wind direction
Shelterbelts and windbreaks are biological barriers composed of trees and shrubs designed to reduce wind speed, control soil erosion, and protect crops from damaging hot, dry winds. To maximize aerodynamic efficiency and shelter area, windbreaks must be planted perpendicular or at right angles to the prevailing wind direction, reducing desiccation stress and mechanical lodging in sugarcane fields.

65. (A) 2 percent
Agronomic measures for soil and water conservation include practices like contour cultivation, strip cropping, mulching, and cover cropping. These soft management practices modify surface cover and micro-topography to retard surface runoff and enhance infiltration. They are most effective and economically viable on gently sloping agricultural lands possessing a natural slope gradient of less than two percent.

66. (A) Zinc
Continuous high-intensity cropping and heavy nitrogenous fertilization in Terai soils frequently deplete plant-available micronutrients. Zinc deficiency is widespread in these moist, organic-rich soils, famously causing Khaira disease in rice crops. In sugarcane, zinc deficiency restricts internode elongation, causes leaf chlorosis, reduces photosynthetic capacity, and ultimately leads to substantial reductions in total cane and sugar yield.

67. (C) Zinc, Iron, and Manganese
A soil pH of nine point two and an exchangeable sodium percentage of twenty-five define a strongly sodic soil environment. High alkalinity and excess hydroxyl ions precipitate micronutrient cations into insoluble hydroxides and carbonates. Consequently, crops grown in these soils exhibit severe deficiencies of essential micronutrients including zinc, iron, and manganese, requiring corrective micronutrient management alongside sodium reclamation.

68. (C) I, II and III only
A Soil Health Card provides field-specific advisory recommendations to improve nutrient efficiency and soil quality. It outlines precise doses of chemical fertilizers required for target crop yields, recommends suitable organic manures and bio-fertilizers, and specifies soil amendment quantities like gypsum or lime based on soil pH. However, it never mandates purchasing specific commercial fertilizer brands.

69. (C) To allow the replaced soluble sodium sulphate salt to be leached down out of the root zone.
Applying gypsum to sodic soils replaces exchangeable sodium on clay particles with calcium, producing soluble sodium sulphate in the soil solution. Adequate artificial drainage is essential to provide a downward pathway for water, enabling the displaced sodium sulphate to be leached far below the active root zone, preventing re-alkalinization and restoring desirable soil physical structure.

70. (B) Soluble manganese and iron are reduced to toxic forms (MN_2^+ and Fe^{2+}).
Prolonged waterlogging depletes soil oxygen, forcing soil microorganisms to utilize oxidized soil compounds as electron acceptors, which sharply drops soil redox potential. Under these strongly reduced anaerobic conditions, insoluble ferric and manganic oxides are chemically reduced into soluble ferrous and manganous ions. High concentrations of these reduced ions accumulate in soil solution, inducing root toxicity and nutrient imbalance.

71. (D) It provides mechanical support to prevent lodging and improves drainage and aeration in root zones.
Earthing up in sugarcane involves mounding soil from inter-row spaces around the base of

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20. The most widely recommended practical field measure to correct Khaira disease in standing paddy crops is the foliar application of:
(A) Foliar spray of copper sulphate combined with lime
(B) Soil application of ferrous sulphate and ammonium sulphate
(C) Spraying zinc sulphate combined with lime or urea
(D) Direct foliar application of powdered borax solution

21. A sugarcane crop exhibiting weak root development, stunted growth, and a distinct purplish or dark green discolouration on older leaves is most likely suffering from a deficiency of:
(A) Phosphorus
(B) Nitrogen
(C) Calcium
(D) Zinc

22. The characteristic symptom of 'scorching' or 'burning' along the margins and tips of older leaves is primarily associated with a deficiency of:
(A) Magnesium
(B) Molybdenum
(C) Boron
(D) Potassium

23. Consider the following statements regarding nutrient deficiency symptoms:
I. Nitrogen deficiency causes general yellowing starting from older leaves.
II. Zinc deficiency is commonly associated with little leaf or rosette formation.
III. Boron deficiency often leads to cracking of stems and fruits.
IV. Iron deficiency is characterised by interveinal chlorosis on older, lower leaves.
Which of the above statement(s) is/are incorrect?
(A) I and II only
(B) IV only
(C) III and IV only
(D) II, III and IV

24. In Uttar Pradesh, iron chlorosis is a frequent nutritional problem observed particularly in ratoon sugarcane crops grown on which type of soils?
(A) Strongly acidic tropical soils
(B) Poorly drained peaty and marshy soils
(C) Highly calcareous alkaline soils
(D) Highly weathered red lateritic soils

25. Given below are two statements: one is labelled as Assertion (A) and the other as Reason (R).
Assertion (A): The availability of iron, manganese, and zinc to crops decreases significantly in soils with a high pH.
Reason (R): In alkaline conditions, these micronutrients react with hydroxyl ions to form insoluble hydroxides and oxides.
(A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
(B) Both Assertion (A) and Reason (R) are true but R is not the correct explanation of A.
(C) Assertion (A) is true but Reason (R) is false.
(D) Assertion (A) is false but Reason (R) is true.

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26. Which micronutrient deficiency is responsible for the 'Whiptail' physiological disorder commonly observed in cauliflower?
(A) Manganese
(B) Copper
(C) Molybdenum
(D) Zinc

27. Given below are two statements regarding plant nutrients:
Statement I: Death of the apical bud (growing point) is a primary visual symptom of Boron deficiency.
Statement II: Boron is highly mobile within the plant, allowing it to easily relocate to the growing point during deficiency.
(A) Both Statement I and Statement II are correct
(B) Both Statement I and Statement II are incorrect
(C) Statement I is correct but Statement II is incorrect
(D) Statement I is incorrect but Statement II is correct

28. Which of the following essential nutrients is immobile within the plant system?
(A) Nitrogen
(B) Phosphorus
(C) Potassium
(D) Calcium

29. Maize is frequently cultivated as an 'indicator plant' in agricultural science to visually assess the deficiency of which specific micronutrient in the soil?
(A) Boron

as a powerful chemical buffer, resisting rapid fluctuations in soil pH while substantially increasing cation exchange capacity and total moisture retention.

45. (A) P-2, Q-4, R-1, S-3
Bhabhar and Terai soils extend across northern sub-Himalayan districts like Lakhimpur Kheri and Pilibhit. Alluvial plains cover central districts including Kanpur, Lucknow, and Varanasi. Vindhyan soils develop over sandstone and shale formations in Mirzapur and Sonbhadra. Bundelkhand soils are characterized by distinct red and dark clayey soils spread across southern districts like Jhansi, Jalaun, and Lalitpur.

46. (D) Sand, silt, and clay
Soil textural class is determined by the relative percentage proportions of three primary mineral separates: sand, silt, and clay, excluding gravel and organic matter fractions. Sand particles range from two to zero point zero five millimeters, silt from zero point zero five to zero point zero zero two millimeters, and clay particles measure less than zero point zero zero two millimeters in diameter.

47. (A) Clay
Fine-textured clay soils possess an exceptionally high total pore space dominated by microscopic capillary pores. Consequently, clay soils exhibit the highest total water-holding capacity among all textural classes. However, because water is held tightly within tiny pores under high matric suction, a significant portion remains held beyond the permanent wilting point and is unavailable for plant absorption.

48. (B) Sandy soil
Coarse-textured sandy soils are dominated by large mineral particles with low specific surface area and non-capillary macro-pores. Because macro-pores offer minimal resistance to fluid flow and low capillary suction, water moves rapidly through the soil matrix under gravity. Consequently, sandy soils inherently exhibit the highest rates of water infiltration and deep drainage percolation among all soil textural classes.

49. (B) Accumulation of toxic reduced compounds like hydrogen sulphide, causing poor root growth and tillering.
Prolonged waterlogging in sugarcane fields displaces soil air from pore spaces, creating anaerobic conditions. Under oxygen-depleted environments, obligate anaerobes reduce soil constituents, leading to the accumulation of toxic reduced substances such as hydrogen sulphide, ferrous iron, and manganous ions. These reduced compounds damage root membranes, impair root respiration, suppress tillering, and severely retard crop growth.

50. (B) Bhabhar → Terai → Alluvial Plains → Bundelkhand/Vindhyan
Traveling from the northern sub-Himalayan border southward across Uttar Pradesh reveals distinct soil belts. Immediately below the Shivalik hills lies the coarse, porous Bhabhar belt, followed southward by the moist, fine-textured Terai region. Continuing south leads into the extensive Gangetic Alluvial Plains, before reaching the elevated, weathered plateau soils of the southern Bundelkhand and Vindhyan regions.

51. (A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
Sugarcane cultivation involving heavy machinery creates compacted hardpans below the plough layer, restricting root extension and water movement. Deep ploughing or subsoiling breaks this dense subsoil layer without turning topsoil. In ratoon management, subsoiling enhances root penetration into deeper subsoil zones, improves moisture infiltration, enhances fertilizer use efficiency, and rejuvenates overall growth and yield of the ratoon crop.

52. (D) $CaSO_4.2H_2O$
Agricultural gypsum is a naturally occurring mineral amendment used extensively for reclaiming sodic and alkali soils. Its official chemical formula is calcium sulphate dihydrate. Upon application to moist soil, gypsum dissolves gradually, supplying soluble calcium ions that displace exchangeable sodium from soil clay minerals. Displaced sodium forms soluble sodium sulphate, which is readily removed through downward leaching practices.

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39. Select the correct order of the following nitrogen fertilisers based on their nitrogen content (highest to lowest percentage):
(A) Anhydrous ammonia, Urea, Ammonium nitrate, Ammonium sulphate
(B) Urea, Anhydrous ammonia, Ammonium sulphate, Ammonium nitrate
(C) Anhydrous ammonia, Ammonium nitrate, Urea, Ammonium sulphate
(D) Urea, Ammonium nitrate, Ammonium sulphate, Anhydrous ammonia

40. In sugarcane, a specific nutritional disorder called 'Pahala blight', which appears as chlorotic streaks later turning into red-brown necrotic spots, is caused by the deficiency of:
(A) Copper
(B) Boron
(C) Manganese
(D) Zinc

41. The phenomenon of 'Nutrient Interaction' is widely observed in soils. High, continuous applications of phosphatic fertilisers often induce the deficiency of which micronutrient in the crop?
(A) Iron
(B) Zinc
(C) Molybdenum
(D) Manganese

42. Given below are two statements: one is labelled as Assertion (A) and the other as Reason (R).
Assertion (A): Application of excessive nitrogen beyond recommended doses makes the sugarcane crop highly susceptible to pests and lodging.
Reason (R): Excess nitrogen promotes rapid, succulent vegetative growth with thinner cell walls and reduces mechanical strength.
(A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
(B) Both Assertion (A) and Reason (R) are true but R is not the correct explanation of A.
(C) Assertion (A) is true but Reason (R) is false.
(D) Assertion (A) is false but Reason (R) is true.

43. Certain elements are toxic to plants when present in excess. The toxicity of which micronutrient is characterised by crinkling of leaves, commonly seen as 'crinkle leaf' in cotton?
(A) Copper
(B) Boron
(C) Zinc
(D) Manganese

44. Consider the following statements regarding nutrient interactions in plants:
I. The relationship between Nitrogen and Potassium is generally synergistic, enhancing crop growth.
II. Excessive application of Calcium can induce Boron deficiency in certain soils.
III. Phosphorus and Molybdenum have a highly antagonistic interaction, reducing each other's uptake.
IV. High levels of Potassium often depress the uptake of Magnesium, potentially causing deficiencies.
Which of the above statement(s) is/are correct?
(A) I, II and IV only
(B) II, III and IV only
(C) I, III and IV only
(D) I, II, III and IV

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45. Given below are two statements regarding soil pH and nutrient availability:
Statement I: Soil pH has a direct and profound effect on nutrient availability to plant roots.
Statement II: Most primary macronutrients are maximally available at a highly acidic soil pH of 4.0 to 5.0.
(A) Both Statement I and Statement II are correct
(B) Both Statement I and Statement II are incorrect
(C) Statement I is correct but Statement II is incorrect
(D) Statement I is incorrect but Statement II is correct

46. Match List I with List II to select the correct answer.
List I: Visual Deficiency Symptom
P. Yellowing of older leaves, uniform chlorosis
Q. Interveinal chlorosis on older leaves
R. Interveinal chlorosis on younger leaves
S. Scorch and burn along leaf margins
List II: Most Likely Deficient Nutrient
1. Potassium
2. Iron
3. Nitrogen
4. Magnesium
(A) P-3, Q-4, R-2, S-1
(B) P-4, Q-3, R-1, S-2
(C) P-3, Q-2, R-4, S-1
(D) P-1, Q-4, R-2, S-3

47. Although not classified as a universally essential primary or secondary nutrient, which beneficial

element is highly accumulated by sugarcane and paddy, providing structural rigidity and resistance against lodging and pests?
(A) Cobalt
(B) Silicon
(C) Vanadium
(D) Sodium

48. Most agricultural crops, including sugarcane, absorb nitrogen from the soil primarily in the form of:
(A) Nitrite (NO_2^-)
(B) Elemental Nitrogen (N_2)
(C) Nitrate (NO_3^-)
(D) Amino acids

49. The concept of 'Crop Logging', developed by Harry F. Clements, is a comprehensive system used extensively for determining the nutritional and irrigation requirements of which specific crop?
(A) Wheat
(B) Sugarcane
(C) Potato
(D) Paddy

50. According to the general package of practices in Uttar Pradesh, what is the approximate recommended dose of Nitrogen for an irrigated, planted sugarcane crop?
(A) 50 - 75 kg/ha
(B) 150 - 180 kg/ha
(C) 300 - 350 kg/ha
(D) 400 - 450 kg/ha

51. At which physiological growth stage does sugarcane exhibit its peak requirement for nitrogen to maximize the number of millable canes?
(A) Germination phase
(B) Tillering and formative phase
(C) Grand growth phase
(D) Ripening and maturation phase

52. Why is the application of heavy doses of nitrogenous fertilisers strongly discouraged during the ripening phase of sugarcane?
(A) It induces premature flowering and permanently halts stalk elongation
(B) It leads to severe stalk cracking and structural rind damage
(C) It promotes vegetative growth while reducing sucrose accumulation
(D) It renders root systems highly susceptible to destructive nematode attacks

53. Which nutrient is particularly applied to sugarcane crops to improve the translocation of sugars from the leaves to the stalk and enhance the commercial cane sugar (CCS) percentage?
(A) Potassium
(B) Phosphorus
(C) Calcium
(D) Nitrogen

54. In the practice of tissue testing for diagnosing the nutritional status of a standing sugarcane crop, which specific leaf is universally selected as the standard indicator tissue?
(A) The mature, oldest senescing leaf located near the base of the main stalk
(B) The top visible dewlap (TVD) leaf, usually the 3rd to 6th leaf
(C) The young, newly emerging spindle leaf at the apex of the plant canopy
(D) The uppermost fully expanded leaf located directly below the inflorescence

55. Select the correct sequential order of the major growth phases of a sugarcane crop from planting to harvest.
(A) Germination → Grand Growth → Formative → Ripening
(B) Germination → Formative (Tillering) → Grand Growth → Ripening
(C) Formative → Germination → Ripening → Grand Growth
(D) Germination → Ripening → Formative → Grand Growth

56. Given below are two statements: one is labelled as Assertion (A) and the other as Reason (R).
Assertion (A): A ratoon crop of sugarcane typically requires a 20-25% higher dose of nitrogen compared to the main planted crop.
Reason (R): The decomposition of left-over stubble and root residues temporarily immobilises soil nitrogen, making it unavailable to the growing ratoon sprouts.
(A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
(B) Both Assertion (A) and Reason (R) are true but R is not the correct explanation of A.
(C) Assertion (A) is true but Reason (R) is false.
(D) Assertion (A) is false but Reason (R) is true.

57. Consider the following statements regarding the application of press mud (a sugar mill

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byproduct) as an organic amendment in sugarcane cultivation:
I. Press mud is an excellent source of organic carbon, phosphorus, and sulphur.
II. Sulphitation press mud is highly acidic and helps in reclaiming saline-alkaline soils.
III. Press mud application reduces the water-holding capacity of the soil.
Which of the above statement(s) is/are correct?
(A) I and II only
(B) II and III only
(C) I and III only
(D) I, II and III

58. For maximising nutrient use efficiency in sugarcane planting, the entire recommended dose of Phosphorus and Potassium should be applied:
(A) As a high-volume foliar spray during the active grand growth phase
(B) As a split top dressing during the early vegetative tillering phase
(C) As a basal dose in furrows during planting
(D) In multiple equal split applications synchronized with field irrigation

59. The 'Critical Nutrient Concentration' refers to the concentration of a nutrient in plant tissue below which:
(A) The plant suffers tissue necrosis and immediately dies
(B) Crop growth, yield, or quality declines
(C) Visual signs of nutrient toxicity begin to appear on leaves
(D) The root system ceases to absorb soil moisture and nutrients

60. Which of the following elements is NOT classified as an essential micronutrient for agricultural crops?
(A) Copper
(B) Nickel
(C) Chlorine
(D) Strontium

61. When collecting a soil sample for general soil fertility evaluation in shallow-rooted field crops, the standard sampling depth recommended is:
(A) 0 to 15 cm
(B) 15 to 30 cm
(C) 30 to 45 cm
(D) 0 to 5 cm

62. For deep-rooted, long-duration crops like sugarcane, soil samples for fertility testing should ideally be drawn from which depth?
(A) 0 to 15 cm only
(B) 0 to 30 cm
(C) 45 to 60 cm
(D) 60 to 90 cm

63. Consider the following statements concerning scientific diagnosis of nutrient deficiency:
I. Soil testing provides a reliable estimate of available nutrients before planting.
II. Plant tissue analysis confirms if the nutrients in the soil are actually being absorbed by the crop.
III. Visual diagnosis alone is infallible because symptoms of different deficiencies never overlap.
IV. Biological tests involve using indicator plants or microbes to assess soil fertility.
Which of the above statement(s) is/are correct?
(A) I, II and III only
(B) I, II and IV only
(C) II, III and IV only
(D) I, III and IV only

64. In the biological nitrogen cycle, the process by which soil nitrates (NO_3^-) are reduced to gaseous nitrogen (N_2 or N_2O) and lost to the atmosphere under waterlogged conditions is called:
(A) Nitrification
(B) Ammonification
(C) Denitrification
(D) Nitrogen fixation

65. Which of the following endophytic nitrogen-fixing bacteria is specifically known to colonise the internal tissues of sugarcane, naturally supplementing its nitrogen requirement?
(A) Rhizobium leguminosarum
(B) Gluconacetobacter diazotrophicus
(C) Frankia
(D) Nitrobacter

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66. Phosphorus Solubilising Bacteria (PSB) enhance the availability of fixed soil phosphorus to plants primarily by:
(A) Producing specific microbial enzymes that directly synthesize ATP in soil
(B) Secreting organic acids to dissolve phosphate minerals
(C) Directly converting and fixing atmospheric phosphorus into soil solutions
(D) Establishing a physical hyphal bridge

contains the highest concentration at eighty-two percent nitrogen. Urea contains forty-six percent nitrogen. Ammonium nitrate supplies thirty-three to thirty-four percent nitrogen. Ammonium sulphate contains twenty-one percent nitrogen along with twenty-four percent sulphur, forming the correct descending order of nitrogen content.

40. (C) Manganese
Pahala blight is a specific physiological disorder in sugarcane caused by manganese deficiency. Symptoms begin as pale green to yellowish interveinal chlorotic streaks running parallel to leaf midribs. As deficiency progresses, these chlorotic areas develop reddish-brown necrotic spots and continuous streaks, leading to leaf splitting, reduced photosynthetic efficiency, and compromised cane yields.

41. (B) Zinc
Continuous and heavy application of phosphatic fertilizers induces an antagonistic interaction with zinc in soil and plant systems. Excessive soil phosphorus forms insoluble zinc phosphate complexes or inhibits root zinc absorption and translocation within plant tissues. This nutrient imbalance induces severe zinc deficiency symptoms, particularly in high-yield cropping systems.

42. (A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
Applying excess nitrogen to sugarcane promotes lush, succulent vegetative growth with thin cell walls and elongated weak internodes. This soft tissue growth reduces structural rigidity, rendering stalks vulnerable to wind lodging. Furthermore, high succulent vegetative growth increases plant sap sweetness and succulence, attracting sucking pests, stem borers, and foliar fungal pathogens.

43. (D) Manganese
Manganese toxicity occurs in strongly acidic or poorly drained soils, causing characteristic visual symptoms across sensitive crops. In cotton plants, excess manganese uptake impairs hormone balance and cell wall expansion, leading to leaf blade distortion, upward cupping, and puckering known as crinkle leaf. Affected plants display stunted growth and reduced yield potential.

44. (A) I, II and IV only
Nitrogen and potassium act synergistically to enhance vegetative growth and yield. Excessive calcium can depress boron uptake. High potassium levels depress magnesium uptake through cation competition. However, phosphorus and molybdenum exhibit a synergistic interaction rather than an antagonistic one, as phosphate ions actually enhance molybdate uptake by plant roots.

45. (C) Statement I is correct but Statement II is incorrect
Soil pH significantly influences chemical solubility and biological availability of nutrients. Primary macronutrients like nitrogen, phosphorus, and potassium are maximally available in slightly acidic to neutral soil pH ranges of 6.0 to 7.5. At highly acidic pH levels of 4.0 to 5.0, macronutrient availability drops severely due to fixation and leaching.

46. (A) P-3, Q-4, R-2, S-1
Nitrogen deficiency causes uniform yellowing of older leaves. Magnesium deficiency exhibits interveinal chlorosis on mature lower leaves because of its mobility. Iron is immobile, causing interveinal chlorosis on newly emerging young leaves. Potassium deficiency causes distinct marginal scorching and tip burning along older leaf margins due to altered water regulation.

47. (B) Silicon
Silicon is a highly beneficial element accumulated in large amounts by graminaceous crops like sugarcane and rice. Deposited as amorphous silica in cell walls and epidermal layers, silicon provides mechanical rigidity, erect leaf canopy architecture, and resistance against lodging. It also forms a physical barrier that reduces insect borer penetration and fungal infections.

48. (C) Nitrate (NO_3^-)
Agricultural crops absorb nitrogen primarily as inorganic nitrate ions from soil solution. Soil microorganisms convert organic nitrogen and ammonium into nitrate through aerobic nitrification. Although flooded paddy rice absorbs nitrogen mainly in ammonium form, upland crops including sugarcane absorb nitrate ions, which are subsequently reduced inside plant cells into amino acids and proteins.

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deficiency and exhibits reduced yield without showing any clear visible diagnostic symptoms?
(A) Toxicity
(B) Hidden Hunger
(C) Antagonism
(D) Luxury Consumption

76. A farmer intends to apply 60 kg of P_2O_5 per hectare to his field. If Single Super Phosphate (SSP) is chosen as the source, approximately how much SSP (containing 16% P_2O_5) will be required per hectare?
(A) 125 kg
(B) 250 kg
(C) 375 kg
(D) 500 kg

77. The 'Law of the Minimum', which states that plant growth is limited by the single essential nutrient that is present in the shortest supply relative to its requirement, was formulated by:
(A) Jethro Tull
(B) Justus von Liebig
(C) V.V. Dokuchaev
(D) M.S. Swaminathan

78. Which of the following statements regarding sulphur application in crops is INCORRECT?
(A) Sulphur significantly promotes root nodule formation and nitrogen fixation in leguminous crops.
(B) Single Super Phosphate is completely devoid of sulphur for crop nutrition.
(C) Sulphur is heavily required by all major oilseed crops to synthesize fatty acids and increase oil content.
(D) Direct application of elemental sulphur requires microbial oxidation in soil before plants can absorb it as sulphate.

79. When an excessive amount of potassium fertiliser is absorbed by a crop far beyond its physiological requirement without any corresponding increase in yield, the phenomenon is termed:
(A) Potassium Fixation
(B) Nutrient Antagonism
(C) Luxury Consumption
(D) Potassium Immobilisation

80. In intensive agriculture, the continuous removal of micronutrients by high-yielding varieties without adequate replenishment leads to severe soil depletion. Which micronutrient deficiency is currently the most widespread in the soils of Uttar Pradesh and India as a whole?
(A) Zinc
(B) Copper
(C) Manganese
(D) Molybdenum

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plants exhibit stunted growth, reduced tillering, delayed maturity, and substantial reduction in grain yield potential.

20. (C) Spraying zinc sulphate combined with lime or urea
Correcting Khaira disease in standing paddy crops requires prompt foliar sprays of zinc sulphate solution. Combining zinc sulphate with slaked lime or urea neutralizes acidity, prevents leaf burning, and improves nutrient absorption. Applying this foliar mixture rapidly restores zinc levels, promotes chlorophyll restoration, cures leaf chlorosis, and revives active growth in affected paddy fields.

21. (A) Phosphorus
Phosphorus deficiency severely impairs root architecture, energy metabolism, and cellular elongation in sugarcane crops. Because phosphorus is mobile within plant tissues, deficiency symptoms first manifest on older leaves. Anthocyanin pigment accumulation causes leaves to turn dark green or distinctly purplish-red along leaf blades and margins, accompanied by stunted stalk growth and poor root development.

22. (D) Potassium
Potassium is a highly mobile element that regulates cellular turgor, water balance, and stomatal movement. When potassium becomes deficient, plants translocate it from mature leaves to growing tissues. This localized depletion leads to marginal chlorosis followed by severe tissue necrosis, giving the tips and margins of older leaves a distinct scorched or burned appearance.

23. (B) IV only
Nitrogen deficiency causes uniform yellowing starting on older leaves. Zinc deficiency causes short internodes, little leaf, and rosette growth. Boron deficiency leads to stem cracking and fruit deformation. However, iron is immobile in plants, so its characteristic interveinal chlorosis develops strictly on newly emerging younger upper leaves, whereas older lower leaves remain completely green.

24. (C) Highly calcareous alkaline soils
In Uttar Pradesh, iron chlorosis frequently affects ratoon sugarcane crops grown on highly calcareous alkaline soils. High soil pH and excessive calcium carbonate reduce solubility and precipitate soluble ferrous iron into insoluble ferric hydroxides. Consequently, crop roots cannot absorb adequate iron, resulting in prominent interveinal chlorosis on young emerging ratoon leaves.

25. (A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
The availability of essential micronutrients such as iron, manganese, and zinc drops significantly in high pH soils. Under alkaline conditions, these metallic cations react readily with abundant hydroxyl ions to form insoluble hydroxides and oxide precipitates. This chemical precipitation locks the micronutrients into non-available forms, directly causing crop deficiency symptoms in high pH environments.

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26. (C) Molybdenum
Whiptail is a well-known physiological disorder in cauliflower caused by molybdenum deficiency, particularly in acidic soils. Molybdenum is required for nitrate reductase activity; its absence leads to nitrate accumulation and severe lamina tissue deformation. Affected leaves become narrow, twisted, strap-like, or severely reduced to just the central leaf midrib resembling a whip.

27. (C) Statement I is correct but Statement II is incorrect
Boron is an essential micronutrient that is highly immobile within plant vascular tissues. Because plants cannot translocate boron from older leaves to expanding growing tips, a deficiency rapidly leads to the death of apical meristems and growing points. This results in terminal bud breakdown, shortened internodes, bushy growth habits, and structural stem cracking.

28. (D) Calcium
Calcium is an immobile element within plant tissues because it is structural in nature and translocated almost exclusively upward through xylem vessel transpiration streams. Once deposited in mature leaves and cell walls as calcium pectate, it cannot be remobilized to young developing tissues, making terminal growing points show deficiency symptoms first under limiting conditions.

29. (C) Zinc
Maize serves as a classic indicator plant in agricultural science for diagnosing soil zinc deficiency. When zinc levels are inadequate,

molecules, and sulphur contributes to protein synthesis, enzyme activation, and oil formation across field crops.

10. (A) P-4, Q-1, R-3, S-2
Nitrogen is a key constituent of amino acids, structural proteins, and chlorophyll molecules. Phosphorus promotes early root development, cell division, and energy transfer through high-energy phosphate bonds. Potassium enhances disease resistance, osmotic water balance, and stomatal movement. Calcium functions as a essential structural component of calcium pectate in the middle lamella of cell walls.

11. (B) Chlorophyll
Magnesium is an essential secondary plant nutrient that serves as the central atom in the porphyrin ring of the chlorophyll molecule. Without adequate magnesium, plants cannot synthesize sufficient chlorophyll, leading to severe interveinal chlorosis. In addition, magnesium acts as an activator for numerous metabolic enzymes involved in carbohydrate transport, protein synthesis, and cellular respiration.

12. (B) Zinc
Zinc is an essential micronutrient that plays a pivotal biochemical role as a co-factor for tryptophan synthase. Tryptophan is the direct amino acid precursor required for the biosynthesis of indole-3-acetic acid, the major natural plant growth hormone known as auxin. Zinc deficiency restricts auxin synthesis, leading to shortened internodes and rosette leaf growth.

13. (A) Boron
Boron is an essential micronutrient involved in reproductive growth, cell wall structural development, and carbohydrate transport. It is strictly required for pollen grain viability and pollen tube growth during fertilisation. Boron also complexation with sugars facilitates their active translocation across cell membranes from photosynthetic donor leaves to developing storage tissues and sink organs.

14. (B) I and III only
Calcium is crucial for plant cell division, middle lamella integrity, and structural strength. Sulphur is essential for synthesizing methionine, cysteine, and cystine amino acids required for proteins in all crops. However, magnesium is universally required by all higher plants, including cereals, because it forms the central core of chlorophyll and activates major metabolic enzymes.

15. (D) The newer, younger leaves at top
Sulphur is relatively immobile within plant tissues because it is bound into structural proteins and amino acids. When soil sulphur supply becomes insufficient, the plant cannot readily remobilize sulphur from mature tissues to developing tissues. Consequently, visual deficiency symptoms such as pale yellowing or chlorosis appear first on the newly emerging younger leaves at the top.

16. (C) Enhances juice quality and prevents scale during processing
Sulphur application in sugarcane cultivation plays a vital role in improving juice quality, sucrose synthesis, and sugar recovery percentage. Balanced sulphur nutrition optimizes nitrogen metabolism, increases juice purity, and reduces non-protein nitrogenous impurities. Proper sulphur nutrition also aids during sugar factory processing by reducing juice viscosity and preventing harmful scale formation in evaporator tubes.

17. (B) Iron
Iron is immobile within plant tissues and essential for chlorophyll biosynthesis and electron transport systems. Under deficient conditions, iron cannot move from older leaves to growing tips. This causes distinct interveinal chlorosis on newly emerging younger leaves, where interveinal blade tissues turn pale yellow or white while the reticulate vein network remains sharply green.

18. (B) 4, 2, 1, 3
Standard scientific soil testing follows a precise chronological sequence for accurate nutrient analysis. First, a representative composite soil sample is collected from the field. Next, the sample is air-dried in shade to prevent nutrient alterations. Then, it is ground and sieved through a standard mesh. Finally, chemical extraction and instrumental analysis are conducted in laboratory settings.

19. (A) Zinc
Khaira disease is a widespread physiological disorder of rice caused by acute zinc deficiency in flooded soils. Symptoms typically manifest two to three weeks after transplanting as chlorotic patches and characteristic reddish-brown or rusty bronze spots on older lower leaves. Affected

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between root hairs and soil particles

67. Given below are two statements regarding nitrogen-fixing biofertilisers:
Statement I: Azotobacter is a free-living, non-symbiotic nitrogen-fixing bacterium widely used as a biofertiliser in non-leguminous crops like sugarcane and wheat.
Statement II: Rhizobium fixes atmospheric nitrogen purely independently in the soil without requiring a host plant.
(A) Both Statement I and Statement II are correct
(B) Both Statement I and Statement II are incorrect
(C) Statement I is correct but Statement II is incorrect
(D) Statement I is incorrect but Statement II is correct

68. Match List I with List II to select the correct answer.
List I: Process in Nutrient Cycling
P. Conversion of Ammonia to Nitrite
Q. Symbiotic Nitrogen Fixation
R. Solubilisation of insoluble Phosphorus
S. Denitrification
List II: Associated Microorganism
1. Pseudomonas species
2. Bacillus megaterium
3. Nitrosomonas
4. Rhizobium species
(A) P-3, Q-4, R-2, S-1
(B) P-4, Q-3, R-1, S-2
(C) P-3, Q-2, R-4, S-1
(D) P-1, Q-4, R-2, S-3

69. The slow weathering of primary soil minerals like micas (biotite, muscovite) and feldspars is the major natural source of which essential plant nutrient in agricultural soils?
(A) Nitrogen
(B) Phosphorus
(C) Potassium
(D) Sulphur

70. Consider the following statements regarding the cycle and availability of nutrients in soils:
I. Increasing soil organic matter generally improves the cycling and availability of micronutrients.
II. The immobilisation of nitrogen occurs when crop residues with a high C:N ratio (like wheat straw) are incorporated into the soil.
III. Mineralisation is the process where inorganic nutrients are converted into organic compounds by microbes.
Which of the above statement(s) is/are correct?
(A) I and II only
(B) II and III only
(C) I and III only
(D) I, II and III

71. What is the most appropriate and cost-effective practical field measure to manage a severe, sudden onset of iron chlorosis in a standing sugarcane crop?
(A) Broad-acre soil application of 100 kg/ha of elemental iron fertilizer
(B) Performing immediate deep ploughing to enhance aeration in the root zone
(C) Foliar spray of 1% Ferrous Sulphate with mild acidifier or urea
(D) Completely withholding field irrigation for a continuous period of 15 days

72. To minimise the problem of 'Phosphorus fixation' in soils rich in iron and aluminium oxides, which application method is best recommended for phosphatic fertilisers?
(A) Uniform broadcasting evenly over the surface of the entire field
(B) Band placement close to the root zone
(C) Direct foliar application during the late maturity stage of crop growth
(D) Top dressing throughout the active vegetative development phase

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73. Which secondary nutrient is a critical component of the middle lamella of plant cells, acting as a cementing material that provides cellular rigidity?
(A) Magnesium
(B) Sulphur
(C) Calcium
(D) Zinc

74. The Carbon to Nitrogen (C:N) ratio is a crucial indicator of nutrient cycling and organic matter decomposition. What is the typical C:N ratio of normal, stabilised arable soils?
(A) 40:1 to 50:1
(B) 100:1 to 120:1
(C) 10:1 to 12:1
(D) 2:1 to 5:1

75. Which one of the following terms refers to the condition where a plant suffers from a nutrient

maize plants quickly display characteristic broad white or pale yellow chlorotic bands on either side of the midrib of young leaves. This rapid visual response helps agronomists identify zinc deficiency in field soils.

30. (A) Diagnosis and Recommendation Integrated System
DRIS stands for Diagnosis and Recommendation Integrated System. It is a mathematical diagnostic approach that uses tissue nutrient ratios rather than absolute concentration values to evaluate plant nutritional status. By comparing dual nutrient ratios against established norms, DRIS identifies deficient, balanced, or excessive nutrients irrespective of crop age, leaf tissue variety, or environmental variations.

31. (B) 6.5 to 7.5
Phosphorus availability in soils is strongly influenced by soil reaction pH values. Maximum phosphorus availability occurs in a slightly acidic to neutral range between 6.5 and 7.5. Below pH 6.0, phosphorus is fixed by iron and aluminium, while above pH 7.5, it precipitates as insoluble calcium phosphate compounds, reducing plant availability.

32. (D) Molybdenum
Molybdenum is an essential trace element whose soil availability increases as soil pH becomes higher and more alkaline. Unlike metallic micronutrients like iron, manganese, zinc, and copper that precipitate at elevated pH levels, molybdenum exists as molybdate anions, which become increasingly soluble and available to crop roots in alkaline soil environments.

33. (C) Yield decline from secondary and micronutrient deficiencies
Continuous application of nitrogenous fertilizers like urea without organic amendments or balanced nutrients causes severe nutrient imbalances in soil. Heavy nitrogen uptake accelerates crop growth, removing secondary macronutrients and micronutrients rapidly from the root zone. Over time, progressive depletion of zinc, sulphur, and iron induces hidden hunger and yield declines in intensive cropping systems.

34. (A) P-2, Q-4, R-1, S-3
Maize and paddy are highly sensitive indicator crops for zinc deficiency, showing chlorotic striping and rusty spots. Sunflower is a prominent indicator plant for boron deficiency due to stem cracking. Sugarcane and sorghum indicate iron chlorosis on alkaline soils. Tomato and rapeseed are sensitive indicator crops for displaying early phosphorus deficiency symptoms.

35. (A) I and II only
In strongly acidic soils, soluble aluminium and iron reach toxic levels that restrict root elongation and crop growth. In saline soils, high salt concentrations impair microbial activity, slowing organic nitrogen mineralization. However, molybdenum availability increases in alkaline soils, so its availability is not restricted in alkaline Usar soils, making the third statement incorrect.

36. (B) Calcium and Sulphur
Agricultural gypsum, chemically expressed as hydrated calcium sulphate, is a soil amendment applied to reclaim sodic soils by displacing exchangeable sodium ions. In addition to improving soil structure and water infiltration, gypsum supplies two essential plant nutrients directly to crops, providing calcium for cell wall structure and sulphate sulphur for protein synthesis.

37. (C) Volatilisation
Surface application of urea on warm, alkaline soils leads to rapid enzymatic hydrolysis by soil urease enzymes, forming ammonium carbonate. In high pH conditions, ammonium ions convert into gaseous ammonia. Without immediate soil incorporation or irrigation, significant quantities of nitrogen escape into the atmosphere as volatile ammonia gas, substantially reducing nitrogen use efficiency.

38. (B) 0.5% Zinc Sulphate with 0.25% slaked lime
To rapidly correct zinc deficiency in a standing sugarcane crop, the standard foliar recommendation is spraying zero point five percent zinc sulphate combined with zero point two five percent hydrated slaked lime. Adding lime neutralizes the acidic solution, preventing foliar scorching, while enabling fast leaf absorption of zinc to restore normal chlorophyll synthesis.

39. (A) Anhydrous ammonia, Urea, Ammonium nitrate, Ammonium sulphate
Nitrogenous fertilizers vary significantly in their elemental nitrogen content. Anhydrous ammonia

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ANSWERS

1. (B) Arnon and Stout
Arnon and Stout proposed the criteria of essentiality for plant nutrients in 1939, which were later refined by Arnon in 1954. An element is deemed essential if the plant cannot complete its life cycle without it, its role is completely specific and non-replaceable, and it is directly involved in plant metabolism.

2. (C) 17
Higher plants require seventeen elements that are recognized as fundamentally essential for their normal vegetative growth, metabolic functions, and reproductive development. These include carbon, hydrogen, oxygen, nitrogen, phosphorus, potassium, calcium, magnesium, sulphur, iron, manganese, zinc, copper, boron, molybdenum, chlorine, and nickel. Nickel was the most recent element added to this universally accepted essential list.

3. (A) Nitrogen
Nitrogen is a fundamental primary macronutrient required in large quantities by plants. It serves as a vital constituent of amino acids, which serve as the building blocks for proteins, enzymes, nucleic acids, and energy-transfer compounds. Additionally, nitrogen forms a key component of the chlorophyll molecule, enabling effective photosynthetic light absorption and carbohydrate synthesis.

4. (C) An essential constituent of energy-rich ATP and ADP molecules
Phosphorus is an essential primary macronutrient termed the energy currency of plant cells. It forms a central structural component of high-energy phosphate bonds in adenosine triphosphate and adenosine diphosphate, which store and transfer metabolic energy. Furthermore, phosphorus is crucial for nucleic acid synthesis, membrane phospholipids, enzymatic regulation, root development, and early crop growth.

5. (A) Potassium
Potassium is a major primary macronutrient operating primarily as an osmotic regulator within plant systems. It regulates the opening and closing of stomata in guard cells, maintains cellular turgor pressure, facilitates enzymatic activation, and aids carbohydrate transport. In crops such as sugarcane, optimal potassium nutrition supports effective water management, drought tolerance, and stalk structural stability.

6. (A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
Nitrogen is highly mobile within the vascular system of growing plants. When nitrogen supply in the soil becomes limiting, plants readily remobilize nitrogen from older, mature tissues and translocate it toward actively growing young shoots and leaves. Consequently, characteristic deficiency chlorosis appears first on the lower mature leaves while upper leaves stay green longer.

7. (B) Nitrogen
Excessive or late applications of nitrogenous fertilizers to sugarcane stimulate continuous vegetative shoot growth at the expense of sucrose accumulation. Late nitrogen prolongs juice acidity, reduces sucrose recovery, and elevates non-protein nitrogen compounds in the juice. Restricting nitrogen application during late growth stages promotes proper cane ripening, sucrose synthesis, juice purity, and superior processing quality.

8. (B) 326 kg
Commercial urea fertiliser contains forty-six percent elemental nitrogen by weight. To deliver a targeted dose of one hundred fifty kilograms of nitrogen per hectare, the total quantity of urea required is calculated by dividing one hundred fifty by forty-six and multiplying by one hundred. This mathematical calculation yields approximately three hundred twenty-six kilograms of urea fertilizer per hectare.

9. (D) Calcium, Magnesium, Sulphur
Secondary plant nutrients are required by crops in moderate amounts compared to primary macronutrients, yet they perform critical physiological roles. Calcium, magnesium, and sulphur constitute this specific category. Calcium maintains cell wall structural integrity, magnesium forms the core of chlorophyll

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49. (B) Sugarcane
Crop Logging is a diagnostic crop management tool developed by Harry F. Clements specifically for sugarcane cultivation. It involves systematically collecting and analyzing cane leaf tissue samples at regular growth intervals. The system tracks moisture, sugar, nitrogen, phosphorus, and potassium status, enabling precise, timely decisions regarding fertilizer applications and irrigation scheduling.

50. (B) 150 - 180 kg/ha
Under irrigated conditions in Uttar Pradesh, the recommended fertilizer dose for planted sugarcane is one hundred fifty to one hundred eighty kilograms of nitrogen per hectare. This quantity provides sufficient nitrogen to support vigorous shoot tillering, stalk development, and high cane yield without causing delayed maturity or sucrose accumulation loss.

51. (B) Tillering and formative phase
Sugarcane requires maximum nitrogen during its formative and tillering phase, occurring between sixty and one hundred twenty days after planting. During this stage, active tillering, shoot production, root expansion, and stalk initiation take place. Adequate nitrogen availability ensures optimum tiller establishment, forming the basis for a high density of millable canes.

52. (C) It promotes vegetative growth while reducing sucrose accumulation
Applying nitrogen during the ripening stage of sugarcane stimulates late, unwanted vegetative growth and sucker production. This diverts photosynthetic sugars away from stalk storage into tissue synthesis. Furthermore, high late nitrogen increases reducing sugars and non-protein nitrogen in juice, impairing sucrose crystallization, lowering juice purity, and reducing sugar recovery percentages.

53. (A) Potassium
Potassium plays a vital role in enzyme activation and phloem transport of photosynthetic sugars from source leaves to storage stalks in sugarcane. Adequate potassium nutrition enhances sucrose synthesis, maintains cellular turgor, improves drought resistance, increases commercial cane sugar percentage, and enhances overall juice purity and processing quality in sugar mills.

54. (B) The top visible dewlap (TVD) leaf, usually the 3rd to 6th leaf
The Top Visible Dewlap leaf, typically corresponding to the third to sixth leaf from the top, serves as the standard indicator tissue for sugarcane nutritional diagnosis. This leaf reflects current metabolic activity and nutrient uptake. Analyzing TVD leaf blade and sheath tissue provides reliable guidance for evaluating crop nutritional status.

55. (B) Germination → Formative (Tillering) → Grand Growth → Ripening
Sugarcane growth progresses through four sequential physiological phases: germination phase from planting to sprouting; formative or tillering phase where shoot density establishes; grand growth phase characterized by rapid internode elongation and biomass accumulation; and ripening phase where vegetative growth slows down and sucrose accumulates within storage stalks prior to harvest.

56. (A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
Sugarcane ratoon crops require twenty to twenty-five percent more nitrogen than plant crops. The soil contains abundant left-over roots and crop stubble with high carbon-to-nitrogen ratios. Microbial decomposition immobilizes available mineral nitrogen temporarily. Supplementary nitrogen fertilizer compensates for this immobilization and promotes early shoot sprouting from subterranean buds.

57. (A) I and II only
Press mud is a sugar factory byproduct rich in organic carbon, phosphorus, sulphur, and trace elements. Sulphitation press mud is acidic, making it an effective soil amendment for reclaiming saline-alkaline soils. Furthermore, organic press mud applications improve soil aggregation, porosity, and overall water-holding capacity rather than reducing it.

58. (C) As a basal dose in furrows during planting
Phosphorus and potassium are relatively immobile in soils. To maximize nutrient use efficiency in sugarcane, the full recommended dose of phosphorus and potassium should be applied as a basal application in planting furrows. Placing these nutrients directly in the root zone ensures early availability for root establishment and tillering.

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59. (B) Crop growth, yield, or quality declines
The critical nutrient concentration in plant tissue diagnosis refers to the specific nutrient level below which crop growth, biomass yield, or economic quality begins to decline. Above this threshold concentration, nutrient levels are adequate for maximum economic yield, whereas concentrations falling below it indicate nutrient deficiency requiring corrective fertilization practices.

60. (D) Strontium
Copper, nickel, and chlorine are universally recognized essential micronutrients required in trace quantities for plant growth, enzymatic activity, and metabolic regulation. In contrast, strontium is a non-essential trace element present in soil that performs no direct physiological function in higher plants and is not required for crop life cycles.

61. (A) 0 to 15 cm
For evaluating soil fertility in shallow-rooted field crops, the standard recommended sampling depth is zero to fifteen centimeters. This surface soil layer, known as the plow layer, contains the highest concentration of organic matter, biological activity, and active plant roots responsible for absorbing applied fertilizers and native soil nutrients.

62. (B) 0 to 30 cm
Deep-rooted, long-duration crops like sugarcane develop extensive root networks extending beyond surface layers. Consequently, soil sampling for fertility evaluation in sugarcane fields should be collected from zero to thirty centimeters depth. Sampling this deeper zone provides a reliable estimate of available nutrient reserves and root zone chemical conditions.

63. (B) I, II and IV only
Soil testing measures pre-planting nutrient levels, tissue analysis evaluates actual nutrient uptake, and biological tests use indicator organisms to assess soil fertility. Visual diagnosis alone is not infallible because different nutrient deficiencies, viral diseases, root pathogens, and environmental stresses frequently express overlapping or confounding visual symptoms on crop leaves.

64. (C) Denitrification
Denitrification is a biological process in anaerobic or waterlogged soils where facultative anaerobic bacteria convert soil nitrates into volatile nitrous oxide and elemental nitrogen gases. This biochemical pathway releases nitrogen back into the atmosphere, causing significant nitrogen losses from agricultural soils, reducing fertilizer efficiency, and contributing to greenhouse gas emissions.

65. (B) Gluconacetobacter diazotrophicus
Gluconacetobacter diazotrophicus is an endophytic nitrogen-fixing bacterium that naturally colonizes stem tissues, roots, and leaves of sugarcane. It fixes atmospheric nitrogen internally within plant tissues, transferring nitrogen directly to the crop host. Inoculating sugarcane with this endophyte reduces reliance on chemical nitrogen fertilizers while improving plant growth and shoot biomass.

66. (B) Secreting organic acids to dissolve phosphate minerals
Phosphorus Solubilizing Bacteria enhance soil phosphorus availability by secreting low molecular weight organic acids, such as citric, gluconic, and succinic acids. These organic acids lower rhizosphere pH and chelate bound cations like calcium, iron, and aluminium, solubilizing insoluble tricalcium phosphate and rock phosphate into orthophosphate forms accessible to plant roots.

67. (C) Statement I is correct but Statement II is incorrect
Azotobacter is a free-living, non-symbiotic aerobic bacterium that fixes atmospheric nitrogen in soil, benefiting non-leguminous crops like sugarcane and wheat. Conversely, Rhizobium bacteria cannot fix nitrogen independently; they form symbiotic root nodules with leguminous host plants, where atmospheric nitrogen fixation takes place inside specialized nodule structures.

68. (A) P-3, Q-4, R-2, S-1
Nitrosomonas bacteria oxidize soil ammonia into nitrite during nitrification. Rhizobium species establish symbiotic associations with legume roots for biological nitrogen fixation. Bacillus megaterium secretes organic acids to solubilize insoluble mineral phosphorus. Pseudomonas species act as facultative anaerobes that carry out denitrification under waterlogged soil conditions.

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69. (C) Potassium
Weathering of primary soil minerals such as potassium feldspars and micas, including muscovite and biotite, serves as the major natural geological source of soil potassium. Slow chemical weathering and physical breakdown release non-exchangeable mineral potassium into exchangeable and soil solution forms, making it available for plant uptake.

70. (A) I and II only
Soil organic matter enhances micronutrient availability through chelation. Incorporating high C:N ratio crop residues like wheat straw causes temporary microbial nitrogen immobilization. Mineralization, however, is the microbial conversion of organic compounds into inorganic mineral forms, while converting inorganic nutrients into organic forms is termed immobilization, making statement III incorrect.

71. (C) Foliar spray of 1% Ferrous Sulphate with mild acidifier or urea
To rapidly correct sudden iron chlorosis in standing sugarcane, foliar application of one percent ferrous sulphate solution combined with urea or a mild acidifier is the most practical, effective method. Foliar sprays bypass soil fixation in high pH soils, allowing direct leaf absorption of iron to restore normal chlorophyll synthesis.

72. (B) Band placement close to the root zone
Phosphatic fertilizers applied to acidic or iron-rich soils suffer rapid phosphorus fixation into insoluble minerals. Band placement close to the root zone minimizes fertilizer contact with soil particles, reducing chemical fixation. This localized placement maintains higher soluble orthophosphate concentrations near active roots, enhancing phosphorus uptake and fertilizer utilization efficiency.

73. (C) Calcium
Calcium is a critical structural secondary nutrient that forms calcium pectate, the main cementing substance in the middle lamella of plant cell walls. Calcium provides structural rigidity, maintains membrane integrity, regulates cell division, and protects plant tissues against enzymatic breakdown by pathogens, ensuring overall stem strength and tissue firmness.

74. (C) 10:1 to 12:1
The carbon to nitrogen ratio reflects soil organic matter stability and microbial activity. Normal, well-drained, stabilized arable surface soils maintain a narrow C:N ratio ranging between 10:1 and 12:1. This equilibrium ratio balances organic decomposition and nitrogen mineralization, maintaining steady available nitrogen supplies for growing crops.

75. (B) Hidden Hunger
Hidden hunger describes a physiological state where a crop suffers from an internal nutrient deficiency that restricts growth, development, and ultimate yield without displaying distinct visual deficiency symptoms on leaves. Plants appear visually normal, but nutrient insufficiency limits potential yield, requiring soil or tissue testing for diagnosis.

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76. (C) 375 kg
Single Super Phosphate fertilizer contains sixteen percent available phosphorus pentoxide. To supply sixty kilograms of phosphorus pentoxide per hectare, the required quantity of Single Super Phosphate is calculated by dividing sixty by sixteen and multiplying by one hundred. This calculation yields exactly three hundred seventy-five kilograms of Single Super Phosphate fertilizer per hectare.

77. (B) Justus von Liebig
The Law of the Minimum was formulated by Justus von Liebig in 1840. It states that plant growth and crop yield are constrained not by total available nutrients, but by the essential nutrient present in the shortest supply relative to requirement. Increasing abundant nutrients will not boost growth until the limiting nutrient is supplied.

78. (B) Single Super Phosphate is completely devoid of sulphur for crop nutrition.
Single Super Phosphate is a valuable phosphatic fertilizer containing sixteen percent phosphorus pentoxide along with twelve percent sulphur and twenty-one percent calcium. Therefore, stating that Single Super Phosphate lacks sulphur is incorrect. Sulphur promotes legume root nodulation, enhances oilseed fatty acid synthesis, and requires microbial oxidation when applied in elemental form.

(D) Mixed fertilizers are physically blended, whereas complex fertilizers are chemically combined

28. Under the Fertilizer Control Order (FCO), what is the maximum permissible limit of biuret in agricultural grade urea used for standard soil application in India?
(A) 0.5 percent
(B) 1.5 percent
(C) 3.0 percent
(D) 5.0 percent

29. Consider the following statements regarding measures to increase Fertilizer Use Efficiency (FUE):
I. Splitting the nitrogen dose over multiple applications matches crop demand.
II. Deep placement of urea super granules reduces volatilization losses.
III. Surface broadcasting of urea on waterlogged soils maximizes its efficiency.
IV. Integration of chemical fertilizers with organic manures improves overall nutrient availability.
Which of the above statement(s) is/are correct?
(A) I, II and III
(B) I, II and IV
(C) II, III and IV
(D) I, III and IV

30. Which of the following is the most widely used potassic fertilizer in India because it is relatively cheaper and readily available?
(A) Potassium nitrate
(B) Sulphate of potash (SOP)
(C) Potassium magnesium sulphate
(D) Muriate of potash (MOP)

31. At what stage is the full recommended dose of phosphorus generally applied in a sugarcane crop?
(A) As a basal dose at the time of planting
(B) As a top dressing during the tillering phase
(C) As a top dressing during the grand growth phase
(D) Half at planting and half at maturity

32. Match the items in List I with List II:
List I: (Terminology)
P. Basal application
Q. Top dressing
R. Foliar spray
S. Fertigation
List II: (Definition)
1. Application of nutrients dissolved in water sprayed over leaves
2. Broadcasting or placing solid fertilizer in a standing crop
3. Applying fertilizers through a drip irrigation network
4. Application of fertilizer uniformly before or at the time of planting
Which of the following is the correct match?
(A) P-4, Q-2, R-1, S-3
(B) P-2, Q-4, R-3, S-1
(C) P-4, Q-1, R-2, S-3
(D) P-3, Q-2, R-1, S-4

33. If a fertilizer inspector collects a sample of DAP from a dealer and testing shows it contains only 12% Nitrogen and 40% P_2O_5, the fertilizer is deemed:
(A) Standard high-purity agricultural grade
(B) Sub-standard or non-compliant under FCO
(C) Customized specialty-grade fertilizer
(D) Premium slow-release controlled formulation

34. High concentrations of nitrates in drinking groundwater, primarily resulting from excessive agricultural fertilizer leaching, can cause which serious health condition in human infants?
(A) Methemoglobinemia (Blue baby syndrome)
(B) Minamata toxicity (Neurological disorder)
(C) Itai-itai syndrome (Cadmium poisoning)
(D) Skeletal fluorosis (Fluoride toxicity)

35. If the recommendation for potassium (K_2O) for a specific sugarcane plot is 60 kg/ha, approximately how much Muriate of Potash (MOP) should be applied?
(A) 60 kg
(B) 100 kg
(C) 120 kg
(D) 150 kg

36. Which of the following describes the correct order of sugarcane growth phases wherein the peak demand for nitrogen and top-dressing applications should be completed?
(A) Germination phase → Tillering phase → Top dressing ends before Grand Growth Phase → Maturity phase
(B) Maturity phase → Tillering phase → Top dressing → Grand Growth Phase
(C) Germination phase → Grand Growth Phase → Tillering phase → Top dressing
(D) Grand Growth Phase → Top dressing →

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CHAPTER 14

Fertilizer Classification And Application Methods

1. What is the nitrogen content in standard agricultural grade urea?
(A) 21 percent
(B) 46 percent
(C) 18 percent
(D) 32 percent

2. Ammonium sulphate contains nitrogen as well as which other important secondary macronutrient essential for sugarcane?
(A) Sulphur
(B) Calcium
(C) Magnesium
(D) Zinc

3. Why is neem-coated urea heavily promoted by the Government of India for crops like sugarcane?
(A) It accelerates volatilization losses of nitrogen gas from soil
(B) It significantly increases the overall hygroscopic nature of urea
(C) It inhibits soil nitrification to ensure slow nitrogen release
(D) It provides active organic carbon directly to developing roots

4. Consider the following statements regarding Single Super Phosphate (SSP):
I. It contains 16 percent phosphorus (P_2O_5).
II. It provides sulphur and calcium in addition to phosphorus.
III. It is completely soluble in water and highly recommended for fertigation.
Which of the above statement(s) is/are correct?
(A) Only I and II
(B) Only II and III
(C) Only I and III
(D) I, II and III

5. Match the items in List I with List II:
List I: (Fertilizer)
P. Muriate of Potash (MOP)
Q. Di-ammonium Phosphate (DAP)
R. Ammonium Sulphate
S. Sulphate of Potash (SOP)
List II: (Principal Nutrient Content)
1. 18% N, 46% P_2O_5
2. 21% N, 24% S
3. 60% K_2O
4. 50% K_2O, 17.5% S
Which of the following is the correct match?
(A) P-3, Q-1, R-2, S-4
(B) P-4, Q-2, R-1, S-3
(C) P-3, Q-2, R-1, S-4
(D) P-1, Q-3, R-4, S-2

6. If a farmer needs to apply 46 kg of phosphorus (P_2O_5) per hectare to a sugarcane field using Di-ammonium Phosphate (DAP), how much DAP is roughly required?
(A) 50 kg
(B) 100 kg
(C) 150 kg
(D) 200 kg

7. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): Basal application of phosphatic fertilizers is strongly recommended rather than top-dressing.
Reason (R): Phosphorus is highly mobile in the soil and easily lost through leaching if not incorporated early.
(A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
(B) Both Assertion (A) and Reason (R) are true but R is not the correct explanation of A.
(C) Assertion (A) is true but Reason (R) is false.
(D) Assertion (A) is false but Reason (R) is true.

8. Which of the following represents the correct sequence of soil testing procedure for accurate fertilizer recommendation?
(A) Soil sampling → Drying and sieving → Chemical analysis → Fertilizer recommendation
(B) Drying and sieving → Chemical analysis →

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(A) I, II and IV
(B) I, III and IV
(C) II, III and IV
(D) I, II, III and IV

47. Match the items in List I with List II:
List I: (Fertilizer Grade/Type)
P. Calcium Ammonium Nitrate
Q. Single Super Phosphate
R. Di-ammonium Phosphate
S. Urea
List II: (Abbreviation/Name)
1. Kisan Khad
2. DAP
3. SSP
4. Carbamide
Which of the following is the correct match?
(A) P-1, Q-3, R-2, S-4
(B) P-4, Q-2, R-3, S-1
(C) P-1, Q-2, R-3, S-4
(D) P-3, Q-1, R-4, S-2

48. Which soil pH range is considered most ideal for the maximum availability of the majority of primary and secondary plant nutrients?
(A) 4.0 to 5.5
(B) 6.5 to 7.5
(C) 8.0 to 9.5
(D) 9.5 to 11.0

49. If a farmer applies only heavy doses of Urea every year without applying DAP or MOP, what is the most likely consequence for his sugarcane crop?
(A) The crop will mature rapidly with exceptionally high juice sucrose content
(B) The crop displays leafy vegetative growth, lodging, and reduced recovery
(C) The cane stalk will grow extremely thick, rigid, and resistant to lodging
(D) The field soil will permanently turn toxic and sterile within a single season

50. Which of the following is NOT a recognized slow-release nitrogenous fertilizer or nitrification inhibitor?
(A) Ammonium nitrate
(B) Neem-coated urea
(C) Sulphur-coated urea
(D) Nitrapyrin

51. In India, the enforcement of the Fertilizer Control Order (FCO) and drawing of fertilizer samples for quality checking at the district level is primarily the responsibility of:
(A) The District Magistrate acting with the Revenue Department
(B) The Superintending Engineer of the State Irrigation Department
(C) The District Agriculture Officer / Fertilizer Inspector
(D) The Lead Bank Manager along with NABARD Field Officers

52. Which primary nutrient is largely responsible for stomatal regulation, disease resistance, and stalk strength in the sugarcane plant?
(A) Nitrogen
(B) Phosphorus
(C) Sulphur
(D) Potassium

53. For a spring-planted sugarcane crop, by which month should the final top dressing of nitrogen ideally be completed to ensure good sugar recovery?
(A) End of April
(B) End of June
(C) End of September
(D) End of November

54. Consider the following statements regarding micronutrient application:
I. Micronutrients are required in very small quantities but are as essential as macronutrients.
II. Soil application of iron is highly effective in calcareous soils due to high mobility.
III. Chelated forms of micronutrients generally remain available to plants for a longer period.
Which of the above statement(s) is/are correct?
(A) Only I and II
(B) Only I and III
(C) Only II and III
(D) I, II and III

55. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): Nitrogenous fertilizers like urea should be incorporated into the soil immediately after broadcasting.
Reason (R): Leaving urea on the soil surface exposes it to the sun and air, leading to significant nitrogen loss through ammonia volatilization.
(A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
(B) Both Assertion (A) and Reason (R) are true

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2. Potassium
3. Nitrogen
4. Iron

Which of the following is the correct match?
(A) P-3, Q-4, R-2, S-1
(B) P-3, Q-1, R-4, S-2
(C) P-4, Q-3, R-1, S-2
(D) P-2, Q-4, R-3, S-1

19. In the context of the Government of India's fertilizer subsidy policy, what does NBS stand for?
(A) National Basic Subsidy
(B) Nitrogen Beneficiary Scheme
(C) Nutrient Based Subsidy
(D) Natural Biological Supplement

20. Why is it mandatory to store urea bags on wooden pallets or raised platforms away from walls in a godown?
(A) To deter unauthorized physical theft from the warehouse premises
(B) To enhance continuous air circulation and maintain ambient warmth
(C) To facilitate the free escape of volatile nitrogenous gases safely
(D) To prevent moisture absorption caused by its hygroscopic nature

21. Consider the following statements regarding the Soil Health Card (SHC) scheme:
I. It provides a printed report of soil nutrient status to farmers.
II. It recommends crop-wise fertilizer doses based on soil test results.
III. SHC covers testing of only primary macronutrients (N, P, K) and ignores micronutrients.

Which of the above statement(s) is/are correct?
(A) Only I
(B) Only I and II
(C) Only II and III
(D) I, II and III

22. What is the standard recommended dose of Nitrogen (N) for a general planted sugarcane crop under irrigated conditions?
(A) 50 - 60 kg/ha
(B) 150 - 180 kg/ha
(C) 250 - 300 kg/ha
(D) 400 - 450 kg/ha

23. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): Application of high doses of nitrogenous fertilizers at the time of sugarcane maturity is strictly avoided.
Reason (R): Excessive late nitrogen promotes vegetative growth, water accumulation in cane tissues, and reduces sugar recovery.
(A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
(B) Both Assertion (A) and Reason (R) are true but R is not the correct explanation of A.
(C) Assertion (A) is true but Reason (R) is false.
(D) Assertion (A) is false but Reason (R) is true.

24. Excessive application of nitrogenous fertilizers in agricultural fields adjacent to water bodies often leads to nutrient enrichment of water, causing algal blooms. What is this process called?
(A) Eutrophication
(B) Ammonification
(C) Nitrification
(D) Salinization

25. Continuous and heavy use of ammonium sulphate over many years without organic amendments is most likely to cause which of the following adverse effects on soil?
(A) It increases soil alkalinity
(B) It increases the water holding capacity
(C) It causes soil acidity
(D) It promotes the buildup of beneficial soil nematodes

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26. Which method of fertilizer application is most suitable for a crop sown with wide spacing like sugarcane, to maximize nutrient availability and reduce weed competition?
(A) Furrow placement or band placement
(B) Surface broadcasting
(C) Foliar application of primary doses
(D) Top dressing before planting

27. What is the primary difference between a mixed fertilizer and a complex fertilizer?
(A) Mixed fertilizers contain only micronutrients, whereas complex fertilizers contain only macronutrients
(B) Mixed fertilizers are always liquid, whereas complex fertilizers are granular
(C) Mixed fertilizers are synthesized in a factory, whereas complex fertilizers are natural organic manures

Soil sampling → Fertilizer recommendation
(C) Chemical analysis → Soil sampling → Drying and sieving → Fertilizer recommendation
(D) Soil sampling → Chemical analysis → Drying and sieving → Fertilizer recommendation

9. A fertilizer containing at least two or more primary major nutrients chemically combined in the manufacturing process is called a:
(A) Straight fertilizer
(B) Mixed fertilizer
(C) Complex fertilizer
(D) Organic amendment

10. Why is Muriate of Potash (MOP) sometimes avoided in crops like tobacco or potato, although it is widely used in sugarcane?
(A) The chloride ion in MOP adversely affects crop quality
(B) The high sodium concentration in MOP causes soil toxicity
(C) The high market price of MOP makes it economically unviable
(D) The accumulation of potassium prevents nitrogen absorption

11. Consider the following statements regarding top-dressing in sugarcane:
I. Nitrogenous fertilizers are primarily used for top-dressing.
II. Top-dressing of nitrogen should ideally be completed before the grand growth phase.
III. Late application of nitrogen improves sucrose accumulation and enhances juice purity.
IV. Adequate soil moisture is necessary for the success of top-dressing.
Which of the above statement(s) is/are correct?
(A) I, II and IV
(B) II, III and IV
(C) I, III and IV
(D) I, II, III and IV

12. Which micronutrient deficiency in sugarcane is commonly manifested as bleaching of young leaves (white appearance) and is often corrected by foliar spray of its sulphate salt?
(A) Zinc
(B) Iron
(C) Boron
(D) Molybdenum

13. What is the standard recommended concentration of urea for a safe foliar spray in most field crops to avoid leaf scorching?
(A) 0.1 to 0.5 percent
(B) 1 to 2 percent
(C) 5 to 7 percent
(D) 10 to 15 percent

14. Identify the incorrect statement regarding the Fertigation technique:
(A) It involves the application of fertilizer along with irrigation water
(B) It provides precise and timely nutrient supply directly to the active root zone
(C) Completely water-soluble fertilizers are required for this method
(D) It significantly reduces fertilizer use efficiency compared to broadcasting

15. Arrange the following methods of fertilizer application in increasing order of typical Nitrogen Use Efficiency (NUE) (from lowest to highest):
1. Fertigation
2. Broadcasting on surface
3. Deep placement/banding
(A) 2, 3, 1
(B) 1, 3, 2
(C) 2, 1, 3
(D) 3, 2, 1

16. Under which act was the Fertilizer (Control) Order (FCO) originally issued in 1957 to regulate the sale, pricing, and quality of fertilizers in India?
(A) Environmental Protection Act
(B) Essential Commodities Act
(C) Agricultural Produce Market Committee Act
(D) Bureau of Indian Standards Act

17. A farmer requires 120 kg of Nitrogen per hectare for a ratoon sugarcane crop. What is the approximate quantity of Urea required to supply this amount of Nitrogen?
(A) 160 kg
(B) 200 kg
(C) 260 kg
(D) 320 kg

18. Match the items in List I with List II:
List I: (Nutrient Deficiency Symptom)
P. Yellowing starts from older leaves (V-shaped)
Q. Interveinal chlorosis on younger leaves
R. Firing or scorching of leaf margins
S. Purpling of older leaves
List II: (Deficient Element)
1. Phosphorus

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Germination phase → Maturity phase

37. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): Foliar application of fertilizers is considered a supplementary method rather than a complete replacement for soil application.
Reason (R): Plants require macronutrients in large quantities which cannot be fully met through the limited absorption capacity of leaves without causing foliar toxicity.
(A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
(B) Both Assertion (A) and Reason (R) are true but R is not the correct explanation of A.
(C) Assertion (A) is true but Reason (R) is false.
(D) Assertion (A) is false but Reason (R) is true.

38. Zinc sulphate should ideally not be mixed and applied together with which of the following fertilizers to avoid the formation of insoluble compounds?
(A) Urea (Carbamide formulation)
(B) Di-ammonium Phosphate (DAP)
(C) Muriate of Potash (KCl formulation)
(D) Ammonium Chloride fertilizer

39. Consider the following statements regarding the role of Phosphorus in sugarcane cultivation:
I. It is essential for extensive root system development.
II. It delays the maturity of the sugarcane crop.
III. It plays a critical role in energy transfer (ATP/ADP) within the plant.
Which of the above statement(s) is/are correct?
(A) Only I and II
(B) Only I and III
(C) Only II and III
(D) I, II and III

40. Recently introduced liquid Nano Urea is characterized by which of the following properties compared to conventional prilled urea?
(A) It is applied via foliar spray with high absorption
(B) It requires substantially larger storage space and transport volume
(C) It possesses a significantly reduced overall nitrogen use efficiency
(D) It is formulated exclusively for basal application during planting

41. A Soil Health Card rates available soil phosphorus (P) in kg/ha. Which of the following ranges is generally classified as "Medium" available soil phosphorus in standard soil testing protocols?
(A) Less than 10 kg/ha
(B) 10 to 24 kg/ha
(C) 25 to 40 kg/ha
(D) More than 50 kg/ha

42. How does the Fertilizer Subsidy Policy of the Government of India primarily benefit the sugarcane farmer?
(A) By fixing heavily discounted maximum retail prices (MRP) at sales outlets
(B) By transferring cash covering full fertilizer costs directly to bank accounts
(C) By offering free mechanical equipment for application to all small farmers
(D) By purchasing harvested sugarcane at higher rates if fertilizers are applied

43. Which of the following is a classic example of a "straight fertilizer"?
(A) NPK 12:32:16
(B) Di-ammonium Phosphate
(C) Zinc-chelate complex
(D) Urea

44. In waterlogged alkaline soils, nitrogen applied in the form of urea or ammonium sulphate is most susceptible to loss through which mechanism?
(A) Immobilization
(B) Volatilization
(C) Fixation into clay lattices
(D) Precipitation

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45. What is the general recommended basal dose of Zinc Sulphate (21% Zn) to correct zinc deficiency in sugarcane soils?
(A) 2 to 5 kg/ha
(B) 20 to 25 kg/ha
(C) 80 to 100 kg/ha
(D) 150 to 200 kg/ha

46. Consider the following statements regarding the Fertigation technique in sugarcane:
I. It requires water-soluble fertilizers.
II. It restricts root growth to a very shallow surface layer, reducing crop anchorage.
III. It reduces leaching losses of nutrients compared to broadcast application.
IV. It requires a drip or micro-sprinkler irrigation system infrastructure.
Which of the above statement(s) is/are correct?

79. (C) Luxury Consumption
Luxury consumption occurs when plants absorb nutrients, particularly potassium, far beyond their physiological requirement for optimum growth without producing any additional increase in biomass or crop yield. Excess potassium accumulates within vacuolar cell sap, representing inefficient fertilizer utilization without conferring further yield benefits to the harvested crop.

80. (A) Zinc
Intensive cropping systems using high-yielding varieties with heavy NPK fertilizer application have depleted soil micronutrient reserves. Zinc deficiency is currently the most widespread micronutrient deficiency across Indian soils, including Uttar Pradesh. Widespread zinc deficiency restricts crop yields, impairs enzymatic activities, and causes physiological disorders like Khaira disease in rice crops.

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but R is not the correct explanation of A.
(C) Assertion (A) is true but Reason (R) is false.
(D) Assertion (A) is false but Reason (R) is true.

56. A farmer receives a Soil Health Card indicating "High" status for available Potassium. According to standard soil-test-based fertilizer recommendations, how should the farmer adjust the general recommended dose of potassium?
(A) Increase the recommended dose by 25 percent
(B) Apply the full standard recommended dose
(C) Reduce the recommended dose by 25 percent
(D) Completely omit potassium application

57. Placing fertilizer in continuous bands on one or both sides of the sugarcane row just below the seed sett level is known as:
(A) Surface broadcasting
(B) Foliar application
(C) Band placement
(D) Pop-up application

58. What is the most effective extension method to demonstrate the benefits of balanced fertilizer use to a group of sugarcane farmers?
(A) Conducting a Frontline Demonstration (FLD) on a farmer's field
(B) Distributing printed informative technical literature in English
(C) Broadcasting generalized radio bulletins on national networks
(D) Conducting mandatory online training courses for rural farmers

59. Which of the following fertilizers does NOT fall under the category of a "Complex Fertilizer"?
(A) NPK 12:32:16
(B) Di-ammonium Phosphate (DAP)
(C) Nitro-phosphate
(D) Single Super Phosphate (SSP)

60. Why has sulphur increasingly been recognized as the "fourth major nutrient" in sugarcane and other commercial crops?
(A) It completely substitutes phosphorus in metabolic plant activities
(B) It is a component of essential amino acids and aids chlorophyll synthesis
(C) It significantly raises soil pH to alkaline levels favoured by crops
(D) It serves as a potent synthetic pesticide protecting against shoot borers

61. Which of the following is the most critical practical limitation when applying primary macronutrients through the foliar spray method?
(A) Spraying causes plant root systems to permanently cease nutrient uptake
(B) Applied nutrients instantly transform into toxic chemical compounds
(C) Only low solution concentrations can be applied to prevent leaf scorch
(D) Application dramatically stimulates weed proliferation across the field

62. Urea formaldehyde and Isobutylidene diurea (IBDU) are examples of which class of fertilizers?
(A) High-density liquid fertilizer solutions
(B) Chelated micronutrient formulations
(C) Water-soluble phosphatic biofertilizers
(D) Slow-release nitrogenous fertilizers

63. In which year did the Government of India mandate that 100 percent of the urea manufactured domestically and imported for agricultural use must be Neem-coated?
(A) 2005
(B) 2010
(C) 2015
(D) 2020

64. A sugarcane farmer is advised to apply nitrogen in three splits: at planting, at tillering, and before grand growth. What is the agronomic rationale behind this practice?
(A) To intentionally increase operational costs and labor requirements during cultivation
(B) To match nutrient supply with peak crop demand while minimizing nitrogen losses
(C) To ensure weed species receive continuous nutrient availability throughout growth
(D) To deliberately reduce sugar accumulation and juice recovery in mature stalks

65. Which of the following phosphatic fertilizers contains phosphorus primarily in a water-soluble form, making it instantly available to the plant?
(A) Finely ground natural rock phosphate
(B) Single Super Phosphate (SSP)
(C) Processed raw bone meal fertilizer
(D) Industrial byproduct basic slag

66. When a sugarcane crop faces a severe drought or water stress condition, adequate supply of which nutrient best helps the plant regulate water loss through stomatal control?
(A) Potassium

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ANSWERS

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1. (B) 46 percent
Standard agricultural grade urea is the most concentrated solid nitrogenous fertilizer widely used in commercial crop production. It contains forty six percent nitrogen in amide form, which readily converts into ammonium and nitrate ions in soil. This high nutrient density makes it an economical choice for fulfilling nitrogen requirements during crucial plant growth phases.

2. (A) Sulphur
Ammonium sulphate serves as an efficient multi-nutrient fertilizer by supplying two vital elements required for crop growth. It contains twenty-one percent nitrogen along with twenty-four percent sulphur. Sulphur acts as an essential secondary macronutrient that plays a fundamental role in chlorophyll formation, protein synthesis, and general enzymatic activity within crops such as sugarcane.

3. (C) It inhibits soil nitrification to ensure slow nitrogen release
Coating urea with neem oil acts as a natural nitrification inhibitor that slows down the activity of specialized soil bacteria. This delayed chemical conversion reduces nitrogen losses caused by leaching and volatile ammonia gas emission. Consequently, plants receive a steady supply of nitrogen over an extended period, significantly improving overall nutrient use efficiency.

4. (A) Only I and II
Single Super Phosphate contains sixteen percent phosphorus along with twelve percent sulphur and nineteen percent calcium. While its phosphorus content is water-soluble, the fertilizer contains insoluble gypsum components that make it unsuitable for fertigation systems. Therefore, it is ideal for basal soil application rather than direct liquid application through drip lines.

5. (A) P-3, Q-1, R-2, S-4
Muriate of Potash provides sixty percent potash, whereas Di-ammonium Phosphate delivers eighteen percent nitrogen and forty-six percent phosphorus. Ammonium Sulphate supplies twenty-one percent nitrogen along with twenty-four percent sulphur. Sulphate of Potash provides fifty percent potash paired with seventeen point five percent sulphur, offering balanced nutritional options tailored to specific crop requirements.

6. (B) 100 kg
Di-ammonium Phosphate contains forty-six percent phosphorus by weight, meaning every one hundred kilograms of fertilizer supplies forty-six kilograms of available phosphate. To apply exactly forty-six kilograms of phosphorus per hectare to a crop field, a farmer must apply precisely one hundred kilograms of commercial fertilizer to meet the targeted nutritional requirement.

7. (C) Assertion (A) is true but Reason (R) is false.
Basal application of phosphatic fertilizers is strongly recommended because phosphorus is immobile in soil and moves very slowly toward plant roots. Placing phosphorus near the seed zone at planting ensures immediate root access. Phosphorus does not leach easily; instead, it rapidly fixes into insoluble compounds when left exposed or unmixed in soil.

8. (A) Soil sampling → Drying and sieving → Chemical analysis → Fertilizer recommendation
Accurate fertilizer management begins with collecting representative soil samples across a field area. Collected soil must be properly shade dried and sieved to remove debris before lab analysis. Chemical testing determines existing nutrient levels and soil reaction, enabling agronomists to formulate precise, field-specific fertilizer recommendations tailored to target crop growth demands.

9. (C) Complex fertilizer
Complex fertilizers are manufactured through chemical reactions between raw ingredients, resulting in uniform granules that each contain two or more primary plant nutrients. Unlike simple physical mixtures, every individual particle delivers an identical ratio of nutrients. This process ensures even distribution across agricultural fields and prevents nutrient segregation during storage or handling.

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(D) Nicotine alkaloid

78. Spraying of 1 percent Ferrous Sulphate solution on sugarcane leaves is done to correct iron deficiency. To improve the absorption and effectiveness of this foliar spray, it is commonly mixed with a small quantity of:
(A) Concentrated Sulphuric Acid
(B) Common Salt (NaCl)
(C) Bleaching powder
(D) Citric acid or Urea

79. In the "ring pit" method of sugarcane planting, where is the initial dose of fertilizer typically applied to maximize its efficiency?
(A) Mixed into soil inside pits before planting setts
(B) Broadcasted uniformly over the entire field surface area
(C) Sprayed evenly across unploughed inter-row soil surfaces
(D) Placed on top of raised ridges situated away from pits

80. Under the Nutrient Based Subsidy (NBS) scheme, the subsidy amount given by the government to fertilizer manufacturers is fixed on the basis of:
(A) The total volume of fertilizer bags distributed by retail dealers
(B) The weight of specific nutrients (N, P, K, S) present in fertilizers
(C) The transport distance between manufacturing plants and retail hubs
(D) The overall landholding size of farmers purchasing retail inputs

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(B) Nitrogen
(C) Calcium
(D) Molybdenum

67. When taking a soil sample from a sugarcane field for standard fertility testing and Soil Health Card preparation, what is the recommended sampling depth?
(A) 0 to 5 cm
(B) 0 to 15 cm
(C) 45 to 60 cm
(D) 1 to 2 meters

68. Which of the following practices is INCORRECT regarding the proper storage of chemical fertilizers?
(A) Storing bags on a raised wooden platform
(B) Ensuring the storage godown is well-ventilated and dry
(C) Keeping urea and superphosphate bags physically separated
(D) Stacking bags touching the warehouse walls to save space

69. Which of the following fertilizers is the "odd one out" based on its primary nutrient contribution?
(A) Urea
(B) Ammonium Nitrate
(C) Muriate of Potash
(D) Calcium Ammonium Nitrate

70. Which recent scheme launched by the Government of India aims to incentivize states to promote alternative fertilizers and balanced use of chemical fertilizers, directly addressing the adverse effects of excessive fertilizer use?
(A) PM-Kisan Samman Nidhi (Direct Income Support Scheme)
(B) PM-PRANAM (Alternative Nutrient Promotion Scheme)
(C) PM-Fasal Bima Yojana (National Crop Insurance Scheme)
(D) PM-Krishi Sinchayee Yojana (Micro-Irrigation Scheme)

71. If a farmer applies 100 kg of Ammonium Sulphate to his field, how much elemental nitrogen has he approximately added to the soil?
(A) 16 kg
(B) 21 kg
(C) 46 kg
(D) 60 kg

72. Excessive and unbalanced use of nitrogen fertilizers is a major source of emissions of which potent greenhouse gas from agricultural fields?
(A) Nitrous oxide (N_2O)
(B) Methane (CH_4)
(C) Chlorofluorocarbons (CFCs)
(D) Sulphur dioxide (SO_2)

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73. Why is top-dressing of urea recommended either immediately after irrigation or when there is adequate soil moisture?
(A) To wash applied urea rapidly beyond root zones into deep groundwater
(B) To inhibit enzymatic hydrolysis and prevent urea chemical breakdown
(C) To facilitate quick dissolution and nitrogen movement to root zones
(D) To avoid chemical reactions between urea and dry soil forming toxic gas

74. To increase the efficiency of applied phosphatic fertilizers and mobilize fixed soil phosphorus, sugarcane setts are often treated or soil is inoculated with which biofertilizer?
(A) Phosphate Solubilizing Bacteria (PSB)
(B) Symbiotic Rhizobium nitrogen-fixing cultures
(C) Free-living Azotobacter biofertilizer strains
(D) Photosynthetic Blue Green Algae (BGA) cultures

75. Which of the following is an example of a popular 100 percent water-soluble complex fertilizer grade extensively used for fertigation in India?
(A) Normal Granular SSP
(B) Basic Slag
(C) Powdered Rock Phosphate
(D) 19:19:19

76. Which fertilizer serves as an excellent source of both Calcium (Ca) and Sulphur (S) and is widely used to reclaim sodic soils before sugarcane planting?
(A) Muriate of Potash (Potassium Chloride)
(B) Agricultural Gypsum (Calcium Sulphate)
(C) Prilled Urea (Carbamide Nitrogen Source)
(D) Di-ammonium Phosphate (Granular DAP)

77. The active compound in neem-coated urea that inhibits the action of Nitrosomonas bacteria and slows down the nitrification process is:
(A) Allicin extract
(B) Curcumin compound
(C) Azadirachtin

10. (A) The chloride ion in MOP adversely affects crop quality
Muriate of Potash contains high amounts of chloride ions that negatively influence quality parameters in specific commercial crops. In tobacco, elevated chloride impairs leaf burning quality, while in potato, it reduces starch accumulation and dry matter content. Consequently, sulphate-based potassic fertilizers are preferred over chloride formulations for sensitive high-value produce.

11. (A) I, II and IV
Top-dressing focuses mainly on applying nitrogenous fertilizers to meet rapid vegetative demand before the grand growth phase. Moisture in the soil is essential to dissolve applied nutrients for root absorption. Late application of nitrogen must be avoided because it stimulates undesirable vegetative flushing, delays crop maturity, and reduces final sucrose recovery.

12. (B) Iron
Iron plays a structural role in chlorophyll synthesis and key metabolic oxidation systems within crops. Severe iron deficiency causes interveinal chlorosis, which rapidly progresses to complete bleaching or whitening of young emerging leaf blades. Foliar application of ferrous sulphate solution effectively restores chlorophyll production and corrects these systemic visual deficiency symptoms.

13. (B) 1 to 2 percent
Foliar spraying requires low chemical concentrations to ensure effective nutrient absorption while preventing osmotic burn on delicate leaf tissue. A solution strength between one and two percent urea provides a safe nitrogen dose for crop foliage. Higher concentrations cause severe leaf scorching, plasmolysis, and tissue desiccation, disrupting photosynthetic machinery.

14. (D) It significantly reduces fertilizer use efficiency compared to broadcasting
Fertigation integrates water-soluble plant nutrients directly into pressurized irrigation systems, delivering dissolved nutrients directly to active root zones. This targeted placement minimizes nutrient losses from volatilization and deep leaching. As a result, fertigation significantly enhances nutrient use efficiency and crop uptake when compared to conventional surface broadcasting application techniques.

15. (A) 2, 3, 1
Surface broadcasting exhibits the lowest nitrogen use efficiency due to significant volatilization and surface runoff losses. Deep placement or subsurface banding reduces exposure to ambient air, thereby improving efficiency. Fertigation achieves the highest nitrogen efficiency by delivering split doses of dissolved nutrients directly into active root zones with micro-irrigation water.

16. (B) Essential Commodities Act
The Fertilizer Control Order was promulgated under Section three of the Essential Commodities Act to regulate the distribution, pricing, and quality standards of fertilizers across India. It empowers governmental authorities to enforce strict quality control, prevent adulteration, register manufacturers and dealers, and maintain price stability for agricultural inputs.

17. (C) 260 kg
Urea contains forty-six percent nitrogen, which means one hundred kilograms of urea delivers forty-six kilograms of pure nitrogen. Fulfilling a crop requirement of one hundred twenty kilograms of nitrogen requires dividing one hundred twenty by point forty-six. This calculation yields approximately two hundred sixty kilograms of commercial urea fertilizer per hectare.

18. (A) P-3, Q-4, R-2, S-1
Nitrogen deficiency causes older leaves to turn light green and develop V-shaped yellowing along middle veins. Iron deficiency creates distinct interveinal chlorosis across young leaves. Potassium deficiency causes edge firing or marginal leaf necrosis, whereas phosphorus deficiency triggers accumulation of anthocyanin pigments, giving older leaves a characteristic dark purple tint.

19. (C) Nutrient Based Subsidy
The Nutrient Based Subsidy policy was implemented to provide financial support to fertilizer manufacturers based on the specific content of primary and secondary nutrients. By fixing annual subsidy rates per kilogram for nitrogen, phosphorus, potassium, and sulphur, this framework encourages balanced fertilizer

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practical experience regarding balanced fertilizer management under realistic local growing conditions.

59. (D) Single Super Phosphate (SSP)
Single Super Phosphate is categorized as a straight phosphatic fertilizer because it is manufactured specifically to supply phosphorus as its primary major nutrient. Complex fertilizers like Di-ammonium Phosphate and NPK formulations undergo factory chemical reactions to combine two or more primary macronutrients within each individual manufactured granule.

60. (B) It is a component of essential amino acids and aids chlorophyll synthesis
Sulphur is recognized as a vital secondary nutrient essential for synthesis of key amino acids like methionine and cysteine. It participates in chlorophyll formation, oil synthesis, and enzyme activity within crop tissues. Continuous high-yield cropping has expanded sulphur deficiencies, making regular sulphur additions necessary for maintaining photosynthetic performance.

61. (C) Only low solution concentrations can be applied to prevent leaf scorch
Foliar fertilizer application is fundamentally restricted by safe salt concentrations acceptable to plant foliage. Concentrated salt solutions cause cell plasmolysis, leaf scorching, and severe tissue damage. Consequently, macronutrients required in high volume cannot be fully supplied through foliage, requiring major nutrient needs to be met through soil applications.

62. (D) Slow-release nitrogenous fertilizers
Urea formaldehyde and Isobutylidene diurea represent synthetic organic nitrogen compounds formulated with low water solubility. These chemical structures undergo slow microbial decomposition and hydrolysis in soil, releasing plant-available nitrogen gradually over extended periods. This controlled release pattern matches continuous crop nitrogen uptake while minimizing leaching losses.

63. (C) 2015
In 2015, the Government of India made it mandatory for domestic manufacturers and importers to supply one hundred percent Neem-coated urea for agricultural use. This policy aimed to reduce diversion of subsidized urea into non-agricultural industrial applications, decrease soil nitrogen losses, and enhance overall nitrogen use efficiency across national farming operations.

64. (B) To match nutrient supply with peak crop demand while minimizing nitrogen losses
Applying nitrogen in split applications aligns nutrient availability with critical plant growth phases, such as tillering and early stalk elongation. Providing nitrogen incrementally reduces nitrogen losses caused by leaching, surface runoff, and ammonia volatilization. This strategy maintains continuous nutrient uptake while preventing excessive early losses from single bulk applications.

65. (B) Single Super Phosphate (SSP)
Single Super Phosphate contains phosphorus predominantly in monocalcium phosphate form, which is water-soluble and immediately available for root absorption. In contrast, rock phosphate, bone meal, and basic slag contain insoluble citrate-soluble or complex phosphate forms that dissolve slowly, requiring acid soil conditions for gradual nutrient release.

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66. (A) Potassium
Potassium plays a fundamental role in regulating cellular osmotic potential and stomatal movement within plant leaves. During water stress conditions, adequate potassium nutrition enables rapid stomatal closure to minimize transpiration losses while maintaining cellular turgor. This physiological mechanism improves crop drought tolerance and mitigates moisture stress damage.

67. (B) 0 to 15 cm
Standard soil sampling for field crops involves collecting surface soil samples from zero to fifteen centimeters depth. This surface layer, known as the plow layer, contains the highest concentration of active roots, applied fertilizers, and organic matter. Analyzing this specific zone provides accurate assessments of available nutrient status.

68. (D) Stacking bags touching the warehouse walls to save space
Stacking fertilizer bags directly against warehouse walls allows dampness to transfer from structural masonry into stored inputs. Moisture exposure causes hygroscopic fertilizers like urea to absorb water, form dense lumps, and degrade physically. Maintaining adequate space between stacks and

placing urea granules deeply into soil, and integrating inorganic fertilizers with organic manures. Conversely, surface broadcasting urea onto waterlogged soils accelerates ammonia volatilization and denitrification losses, drastically reducing overall nitrogen utilization by growing crop roots.

30. (D) Muriate of Potash (MOP)
Muriate of Potash, chemically known as potassium chloride, is the most widely applied potassic fertilizer in Indian agriculture. Its high nutrient concentration of sixty percent potash combined with lower market costs makes it economical for extensive field application. It supplies readily available potassium needed for osmotic regulation and stalk development.

31. (A) As a basal dose at the time of planting
Phosphorus moves extremely slowly through soil profiles and is required early for vigorous root initiation and seedling anchorage. Applying the entire recommended phosphatic fertilizer dose as a basal treatment during planting ensures placed nutrients remain accessible to newly emerging roots, supporting fundamental plant metabolism throughout early development phases.

32. (A) P-4, Q-2, R-1, S-3
Basal application involves incorporating fertilizer before or during crop planting. Top dressing describes applying granular fertilizers to standing crops during growth. Foliar application delivers dissolved nutrients directly onto plant leaves via water sprays. Fertigation supplies dissolved plant nutrients directly through localized drip or micro-irrigation distribution piping networks.

33. (B) Sub-standard or non-compliant under FCO
Standard Di-ammonium Phosphate must contain eighteen percent nitrogen and forty-six percent phosphorus according to statutory specifications under the Fertilizer Control Order. Fertilizer samples failing to meet these minimum nutrient concentrations fall below legal standards and are officially classified as sub-standard inputs, making their commercial distribution illegal across India.

34. (A) Methemoglobinemia (Blue baby syndrome)
Excessive leaching of nitrate fertilizers into groundwater creates elevated nitrate levels in drinking water supplies. When ingested by human infants, intestinal bacteria convert nitrate into nitrite, which binds with hemoglobin to form methemoglobin. This compound impairs oxygen transport in blood, causing severe hypoxia known clinically as methemoglobinemia or blue baby syndrome.

35. (B) 100 kg
Muriate of Potash contains sixty percent potash by weight, meaning one hundred kilograms of fertilizer contains sixty kilograms of available potash. To meet a field target recommendation of sixty kilograms of potash per hectare, applying exactly one hundred kilograms of Muriate of Potash fulfills the nutrient requirement precisely and efficiently.

36. (A) Germination phase → Tillering phase → Top dressing ends before Grand Growth Phase → Maturity phase
Sugarcane grows through germination, tillering, grand growth, and maturity phases sequentially. Nitrogen demand peaks during early shoot production and tillering. All top-dressing nitrogen applications must be completed prior to the grand growth phase so that plants utilize available nitrogen for biomass production without delaying final sucrose accumulation during maturity.

37. (A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
Foliar nutrient spraying serves as a supplementary feeding technique during acute stress or micronutrient deficiency rather than a total replacement for soil fertilization. Major nutrients are needed in large quantities that exceed foliage absorption capacity, as high spray concentrations damage leaf surfaces and cause severe chemical burns on crop tissue.

38. (B) Di-ammonium Phosphate (DAP)
Mixing zinc sulphate directly with phosphatic fertilizers such as Di-ammonium Phosphate forms insoluble zinc phosphate precipitates. Chemical binding renders both zinc and phosphorus unavailable for root uptake, severely reducing nutrient availability in soil. Consequently, zinc sulphate and soluble phosphatic fertilizers must be applied separately or at different crop stages.

39. (B) Only I and III
Phosphorus plays crucial structural roles in energy transfer reactions involving ATP and ADP molecules within crop cells. It stimulates rapid

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root multiplication, improving water uptake and overall plant anchorage. Adequate phosphorus nutrition promotes uniform maturity and crop development rather than causing developmental delays during late growing periods.

40. (A) It is applied via foliar spray with high absorption
Nano Urea contains ultra-fine nitrogen particles engineered for foliar application, penetrating leaf stomata directly to meet plant metabolic requirements efficiently. Its high surface-area-to-volume ratio enhances nutrient uptake compared to conventional solid urea prills. This liquid formulation reduces storage space, transport requirements, and overall environmental nitrogen losses significantly.

41. (B) 10 to 24 kg/ha
Soil testing procedures categorize available phosphorus levels into specific range classes to guide fertilizer applications. Soil test values under ten kilograms per hectare indicate low phosphorus availability, while values between ten and twenty-four kilograms per hectare represent medium status. Concentrations exceeding twenty-five kilograms per hectare are categorized as high phosphorus fertility.

42. (A) By fixing heavily discounted maximum retail prices (MRP) at sales outlets
The national fertilizer subsidy policy supports agricultural producers by fixing affordable maximum retail prices for key chemical fertilizers at retail distribution points. The government pays subsidy disbursements directly to manufacturing and importing companies to cover production cost gaps, ensuring farmers purchase high-quality inputs at standardized, heavily discounted retail rates nationwide.

43. (D) Urea
Straight fertilizers are single-nutrient input sources designed to supply only one primary plant nutrient to growing crops. Urea represents a classic straight fertilizer because it provides exclusively nitrogen at forty-six percent concentration. Complex fertilizers like Di-ammonium Phosphate or NPK blends supply multiple major nutrients within each individual particle.

44. (B) Volatilization
In waterlogged, high-pH alkaline soils, applied ammonium ions convert rapidly into free ammonia gas. High soil pH favors the chemical equilibrium shift toward gaseous ammonia, which rapidly escapes into the atmosphere. This process, known as ammonia volatilization, drastically reduces nitrogen retention and fertilizer efficiency in warm, alkaline agricultural fields.

45. (B) 20 to 25 kg/ha
Correcting zinc deficiencies in crop soils requires applying twenty to twenty-five kilograms of zinc sulphate containing twenty-one percent zinc per hectare during soil preparation. This basal rate supplies adequate available zinc for seedling development, aiding chlorophyll formation, enzyme activation, and shoot elongation throughout early vegetative growth stages.

46. (B) I, III and IV
Fertigation applies completely soluble fertilizers through pressurized drip networks directly into root zones, reducing deep leaching and enhancing nutrient efficiency. Contrary to restricting root systems, localized micro-irrigation encourages deeper, denser root growth under proper management. The process requires pressurized irrigation infrastructure to regulate flow rates and nutrient concentrations accurately.

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47. (A) P-1, Q-3, R-2, S-4
Calcium Ammonium Nitrate is widely designated as Kisan Khad in trade, while Single Super Phosphate is standardly abbreviated as SSP. Di-ammonium Phosphate is universally referred to as DAP, and Urea is chemically named carbamide. These commercial and scientific terms identify standard fertilizer formulations utilized across agricultural management programs.

48. (B) 6.5 to 7.5
A slightly acidic to neutral soil pH ranging between six point five and seven point five presents optimal chemical conditions for nutrient availability. Within this range, primary macronutrients, secondary nutrients, and essential micronutrients remain highly soluble without precipitating into toxic or unavailable chemical forms, ensuring maximal plant root absorption.

49. (B) The crop displays leafy vegetative growth, lodging, and reduced recovery
Applying nitrogen exclusively without balanced phosphorus and potassium nutrition stimulates excessive vegetative shoot growth while weakening stalk rigidity. Unbalanced nitrogen accumulation delays crop maturity, increases lodging susceptibility, and elevates non-sugar impurities in sap. This nutritional imbalance reduces overall juice purity and commercial sucrose extraction rates in harvested sugarcane stalks.

50. (A) Ammonium nitrate
Ammonium nitrate is a quick-acting, highly soluble straight nitrogenous fertilizer that releases nitrate and ammonium ions immediately upon dissolution in moist soil. Unlike neem-coated urea, sulphur-coated formulations, or nitrapyrin chemicals, it contains no biological inhibitors or protective physical coatings to delay nitrogen breakdown and slow down nutrient release.

51. (C) The District Agriculture Officer / Fertilizer Inspector
Statutory enforcement of the Fertilizer Control Order at district levels is assigned to designated Fertilizer Inspectors and District Agriculture Officers. These authorized officers conduct regular retail facility inspections, draw official chemical samples for laboratory verification, monitor input pricing, and initiate legal proceedings against non-compliant suppliers or adulterated input manufacturers.

52. (D) Potassium
Potassium regulates internal osmotic potential, controlling guard cell turgor pressure for stomatal opening and closing. It strengthens plant cell walls, enhancing stalk mechanical strength to prevent lodging under heavy yields. Additionally, adequate potassium levels increase systemic resistance against fungal pathogens, environmental stress, and common insect pests during growth.

53. (B) End of June
For spring-planted crops, nitrogen top-dressing should be completed by the end of June before monsoon rains start and grand growth accelerates. Applying nitrogen beyond this timeframe promotes late vegetative tillering, suppresses sugar accumulation, delays stalk maturity, and ultimately reduces total sucrose content at harvest time.

54. (B) Only I and III
Micronutrients are mandatory for plant growth despite being required in minute quantities. Soil application of iron is often ineffective in alkaline calcareous soils because dissolved iron rapidly precipitates into insoluble hydroxides. Utilizing chelated micronutrient formulations keeps metals soluble and accessible to roots across diverse soil chemical conditions.

55. (A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
Broadcasting urea onto soil surfaces without incorporation exposes urea to soil urease enzymes, ambient heat, and airflow. Rapid enzymatic hydrolysis converts urea into volatile ammonia gas, which escapes into the atmosphere. Immediate soil incorporation places urea underground, ensuring produced ammonium ions bind to soil particles for root uptake.

56. (C) Reduce the recommended dose by 25 percent
Soil test results guide adjusted fertilizer applications based on existing nutrient reserves in agricultural plots. When testing shows a high status for available potassium, standard guidelines recommend reducing the general potassium fertilizer dose by twenty-five percent. This adjustment avoids wasteful fertilizer expenditure while maintaining optimum soil fertility levels.

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57. (C) Band placement
Band placement involves placing concentrated streams of solid fertilizer in continuous bands beside and below seed setts during planting operations. Positioning nutrients near expanding root systems enhances early nutrient uptake while minimizing chemical fixation reactions in bulk soil. This targeted method also reduces fertilizer accessibility to competing weed growth.

58. (A) Conducting a Frontline Demonstration (FLD) on a farmer's field
Frontline Demonstrations offer field-based educational opportunities by showcasing recommended practices directly alongside conventional farmer methods on active farmland. Observing tangible improvements in crop yield and soil health builds farmer trust, accelerates technology adoption, and provides

application and reduces distorted reliance on single inputs.

20. (D) To prevent moisture absorption caused by its hygroscopic nature
Urea possesses high hygroscopicity, causing it to absorb atmospheric moisture rapidly when exposed to humid ambient air. Direct contact with damp godown floors or walls causes prills to dissolve, cake into hard lumps, and degrade in physical quality. Storing bags on elevated wooden platforms maintains structural integrity and dry conditions.

21. (B) Only I and II
The Soil Health Card scheme delivers detailed field assessments to farmers by documenting twelve vital parameters, including macronutrients, secondary nutrients, micronutrients, and physical properties. It offers tailored fertilizer recommendations for specific crop rotations based on soil analysis. By testing macro and micronutrients alike, the scheme promotes balanced and sustainable soil nutrient management.

22. (B) 150 - 180 kg/ha
Planted sugarcane produces large biomass yields and requires substantial nitrogen nutrition during early growth and tillering phases. Standard agronomic recommendations for irrigated conditions prescribe one hundred fifty to one hundred eighty kilograms of nitrogen per hectare. Applying this optimum dose ensures robust shoot development without causing lodging or delayed sucrose accumulation.

23. (A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
Nitrogen applications are deliberately stopped well before crop harvest to promote proper stalk maturation. High nitrogen levels late in the growing cycle stimulate continuous vegetative shoot growth, increase tissue water content, and promote non-protein nitrogen compounds. This physiological shift inhibits sucrose synthesis, delays maturity, and severely reduces commercial sugar recovery.

24. (A) Eutrophication
Runoff containing excess nitrogen and phosphorus from fertilized fields enriches adjacent aquatic ecosystems, leading to rapid proliferation of microalgae. This dense algal bloom blocks sunlight penetration and depletes dissolved oxygen upon plant decomposition. This ecological degradation process is known as eutrophication, causing severe hypoxia and widespread mortality in aquatic organisms.

25. (C) It causes soil acidity
Continuous application of ammonium sulphate releases ammonium ions into soil, which undergo biological nitrification by specialized soil bacteria. This oxidation process generates hydrogen ions that gradually deplete soil base saturation and lower pH levels. Over time, repeated heavy applications without liming or organic amendments induce significant soil acidity.

26. (A) Furrow placement or band placement
Wide-row crops like sugarcane benefit greatly from localized nutrient placement near the root zone. Furrow or band placement puts concentrated fertilizer bands near developing roots, maximizing plant absorption and minimizing nutrient tie-up in bulk soil. This targeted method reduces fertilizer access for surrounding weed species between rows, promoting crop vigor.

27. (D) Mixed fertilizers are physically blended, whereas complex fertilizers are chemically combined
Mixed fertilizers are formulated by physically blending separate dry fertilizer materials together without chemical reactions, which can lead to particle segregation during storage. In contrast, complex fertilizers are produced through factory chemical processes, forming homogenous granules where every individual particle contains an identical proportion of specified primary plant nutrients.

28. (B) 1.5 percent
Biuret is a toxic byproduct formed during urea manufacturing when high temperatures occur during concentration processes. High biuret levels cause phytotoxicity, damaging seed germination and root tips. To protect agricultural crops, the Fertilizer Control Order strictly limits maximum permissible biuret content to one point five percent for standard land-applied urea formulations.

29. (B) I, II and IV
Fertilizer use efficiency increases when splitting nitrogen applications to match growth demand,

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warehouse walls ensures air circulation and keeps stored bags dry.

69. (C) Muriate of Potash
Muriate of Potash provides potassium as its primary major nutrient, whereas Urea, Ammonium Nitrate, and Calcium Ammonium Nitrate are straight nitrogenous fertilizers designed to supply nitrogen. Muriate of Potash is the odd fertilizer out within this group due to its distinct potassic chemical composition and plant nutritional role.

70. (B) PM-PRANAM (Alternative Nutrient Promotion Scheme)
PM-PRANAM was introduced by the Government of India to encourage state governments to reduce chemical fertilizer consumption and promote balanced nutrient management. The scheme incentives adoption of alternative biofertilizers and organic inputs, aiming to protect soil health, decrease environmental degradation, and lower the national fertilizer subsidy burden sustainable over time.

71. (B) 21 kg
Ammonium sulphate contains twenty-one percent elemental nitrogen and twenty-four percent sulphur in its standard chemical formulation. Consequently, applying one hundred kilograms of ammonium sulphate fertilizer to an agricultural field adds precisely twenty-one kilograms of nitrogen directly to the soil to support early plant development and crop growth.

72. (A) Nitrous oxide (N_2O)
Unbalanced or excessive application of nitrogenous fertilizers provides excess nitrate and ammonium ions in soil. Soil microbes process these nitrogen forms through nitrification and denitrification pathways, releasing nitrous oxide into the atmosphere. Nitrous oxide represents a potent greenhouse gas with high global warming potential and ozone depletion capacity.

73. (C) To facilitate quick dissolution and nitrogen movement to root zones
Top-dressing urea when adequate soil moisture is present ensures rapid dissolution of prills and movement of dissolved nitrogen into root zones. Proper moisture prevents urea from remaining exposed on dry surface soil, where ambient temperatures and airflow accelerate enzymatic hydrolysis, leading to severe ammonia volatilization losses.

74. (A) Phosphate Solubilizing Bacteria (PSB)
Soil-applied phosphorus frequently binds with iron, aluminum, or calcium, becoming insoluble and unavailable to crops. Inoculating setts or soil with Phosphate Solubilizing Bacteria produces organic acids that solubilize fixed soil phosphates. This microbial activity converts bound phosphorus into soluble forms, improving phosphorus uptake and overall fertilizer utilization efficiency.

75. (D) 19:19:19
The 19:19:19 formulation represents a completely water-soluble complex fertilizer supplying equal proportions of nitrogen, phosphorus, and potassium. Because it dissolves entirely in water without clogging emitters, it is widely utilized for fertigation and foliar feeding, providing balanced plant nutrition directly to active root systems through micro-irrigation lines.

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76. (B) Agricultural Gypsum (Calcium Sulphate)
Agricultural gypsum, chemically defined as calcium sulphate dihydrate, supplies essential calcium and sulphur nutrients to crops. It is widely applied to reclaim sodic soils because calcium ions replace exchangeable sodium on clay complexes, improving soil structure, water infiltration, and root aeration prior to planting susceptible agricultural crops.

77. (C) Azadirachtin
Azadirachtin and associated triterpenoids extracted from neem seeds act as natural nitrification inhibitors when coated onto urea prills. These bioactive compounds suppress Nitrosomonas bacteria activity in soil, delaying the conversion of ammonium into nitrate ions. This slow release reduces leaching and volatilization, ensuring sustained nitrogen supply.

78. (D) Citric acid or Urea
Ferrous sulphate sprays correct iron chlorosis on crop foliage, but iron oxidation can form insoluble precipitates. Mixing small amounts of citric acid or urea lowers spray solution pH and keeps iron in soluble ferrous form. Additionally, urea breaks leaf surface tension, significantly improving foliar iron absorption.

(A) P-2, Q-1, R-4, S-3
(B) P-1, Q-2, R-3, S-4
(C) P-4, Q-3, R-2, S-1
(D) P-2, Q-4, R-1, S-3

31. Regular application of organic manures improves the physical condition of the soil by:
(A) Significantly increasing the overall soil bulk density values
(B) Drastically decreasing total soil porosity and aeration capacity
(C) Rendering the soil solution highly alkaline across all horizons
(D) Enhancing soil aggregation and water holding capacity

32. Which substance is commonly used as a sticker/ adhesive while treating seeds with biofertilizer cultures?
(A) Refined mustard vegetable oil
(B) Pure liquid kerosene fuel
(C) Jaggery (Gur) solution
(D) Diluted formalin chemical

33. If seed treatment with biofertilizers is not possible, what is the next best recommended method for their application?
(A) Mixing with chemical weedicides and spraying
(B) Mixing with fine soil or well-rotted FYM and broadcasting before sowing
(C) Dusting dry biofertilizer powder over the standing crop leaves
(D) Dissolving in concentrated urea solution and applying as a top dressing

34. In sugarcane cultivation, what is the standard method of applying biofertilizers like Acetobacter or PSB?
(A) Foliar spraying heavily on mature sugarcane leaves during early morning hours
(B) Thermal fumigation of the entire crop field using specialized biofertilizer smoke
(C) Soil application restricted strictly to the late grand growth phase of the crop
(D) Sett treatment by dipping setts in biofertilizer solution before planting

35. Given below are two statements, one labelled as Assertion (A) and the other as Reason (R).
Assertion (A): Application of raw, undecomposed cow dung in sugarcane fields should be avoided.
Reason (R): Undecomposed dung requires nitrogen from the soil for decomposition and strongly attracts termite infestation.
Select the correct answer from the options given below:
(A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
(B) Both Assertion (A) and Reason (R) are true but R is not the correct explanation of A.
(C) Assertion (A) is true but Reason (R) is false.
(D) Assertion (A) is false but Reason (R) is true.

36. An effective INM strategy in typical sugarcane cultivation aims to substitute what percentage of the recommended chemical nitrogen dose through organic and biological sources?
(A) 5%
(B) 25%
(C) 75%
(D) 100%

37. Long-term continuous use of only chemical fertilizers like Urea, without any organic manures, generally leads to:
(A) Decline in soil organic carbon and microbial activity
(B) A rapid and sustained increase in overall soil organic carbon levels
(C) A marked long-term improvement in soil physical structure and porosity
(D) A permanent increase in the soil's natural water holding capacity

38. The practice of incorporating crop residues back into the soil instead of burning them primarily improves nutrient cycling by retaining which volatile nutrient that is otherwise completely lost during burning?
(A) Phosphorus
(B) Potassium
(C) Calcium
(D) Nitrogen

39. Incorporating crop residues with a very high Carbon:Nitrogen (C:N) ratio directly into the soil prior to sowing may lead to a temporary deficiency of which nutrient for the emerging crop?
(A) Phosphorus
(B) Nitrogen
(C) Potassium
(D) Iron

40. Consider the following statements regarding the establishment of a biofertilizer production unit:
I. An autoclave is required for sterilizing the

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CHAPTER 15

Integrated Nutrient Management and Biofertilizers

1. What is the primary objective of Integrated Nutrient Management (INM) in agriculture?
(A) To completely eliminate the use of chemical fertilizers
(B) To maintain long-term soil health and optimize crop productivity
(C) To increase the reliance solely on imported synthetic fertilizers
(D) To eradicate all soil microbes to prevent root diseases

2. Which of the following is not considered a component of Integrated Nutrient Management?
(A) Chemical fertilizers
(B) Organic manures
(C) Biofertilizers
(D) Synthetic herbicides

3. In sugarcane cultivation, the application of organic manures alongside chemical fertilizers primarily helps in which of the following?
(A) Improving soil organic carbon and nutrient use efficiency
(B) Decreasing the sugar recovery percentage
(C) Enhancing the population of harmful root borers
(D) Promoting premature flowering in sugarcane

4. What defines a biofertilizer in agricultural science?
(A) A chemical compound that provides instant nutrients to plants
(B) An organic extract obtained purely from decomposed earthworms
(C) A preparation containing live or latent cells of efficient microbial strains
(D) A synthetic growth hormone applied to leaves

5. Match the biofertilizer in List I with its primary function in List II.
List I: Biofertilizer
P. Rhizobium
Q. Azotobacter
R. VAM
S. Pseudomonas striata
List II: Primary Function
1. Phosphate solubilization
2. Free-living nitrogen fixation
3. Symbiotic nitrogen fixation in legumes
4. Enhanced phosphorus uptake via root extension
(A) P-3, Q-2, R-4, S-1
(B) P-2, Q-3, R-1, S-4
(C) P-3, Q-4, R-2, S-1
(D) P-1, Q-2, R-4, S-3

6. Which of the following biofertilizers is exclusively recommended for pulse crops to enhance symbiotic nitrogen fixation?
(A) Azotobacter
(B) Azospirillum
(C) Cyanobacteria
(D) Rhizobium

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7. The typical recommended dose of Rhizobium culture required to treat 10 kg of pulse seeds is approximately:
(A) 50 grams
(B) 200 grams
(C) 500 grams
(D) 1000 grams

8. Which specific species of Rhizobium is highly effective for nodulation and nitrogen fixation in soybean?
(A) Rhizobium meliloti
(B) Rhizobium leguminosarum
(C) Rhizobium japonicum
(D) Rhizobium trifolii

9. Azotobacter is best described as which type of microorganism?
(A) Symbiotic nitrogen-fixing fungal species
(B) Anaerobic phosphate-solubilizing bacterial species
(C) Parasitic soil-dwelling plant nematode species

79. (A) Mixed into soil inside pits before planting setts

In the ring pit planting system, basal fertilizers are mixed thoroughly into loose soil inside prepared circular pits prior to placing seed setts. Localizing nutrients directly within the immediate rooting zone ensures high nutrient concentration around developing roots, minimizing fertilizer fixation losses and improving nutrient absorption efficiency.

80. (B) The weight of specific nutrients (N, P, K, S) present in fertilizers

Under the Nutrient Based Subsidy policy, government financial subsidies for non-urea fertilizers are calculated based on specific elemental nutrient contents. Fixed per-kilogram subsidy rates are assigned annually for nitrogen, phosphorus, potassium, and sulphur. Manufacturers receive subsidies according to the exact nutrient composition present in each fertilizer formulation.

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II. Application of FYM improves soil structure and water holding capacity.
III. FYM should be applied and immediately sown over on the same day to avoid nutrient loss.
IV. Un-decomposed FYM can attract termites in the field.
Which of the above statement(s) is/are correct?
(A) I, II, and III
(B) I, II, and IV
(C) II, III, and IV
(D) I, III, and IV

21. Which green manure crop is highly recommended for the reclamation of alkaline (usar) soils?
(A) Dhaincha
(B) Sunhemp
(C) Cowpea
(D) Moong

22. What is the botanical name of Dhaincha, a prominent green manure crop?
(A) Crotalaria juncea
(B) Vigna radiata
(C) Cyamoψs tetragonoloba
(D) Sesbania aculeata

23. At what stage should a green manure crop ideally be ploughed down and incorporated into the soil for maximum benefit?
(A) Early vegetative seedling stage
(B) Pre-flowering to flowering stage
(C) Late pod formation and filling stage
(D) Full maturity and seed drying stage

24. Which earthworm species is most commonly and successfully used for commercial vermicomposting?
(A) Lumbricus terrestris
(B) Pheretima posthuma
(C) Eisenia fetida
(D) Eudrilus eugeniae

25. Select the correct logical sequence of steps involved in the scientific preparation of vermicompost.
(A) Release of earthworms → Site selection → Harvesting → Watering → Bed preparation
(B) Site selection → Bed preparation → Release of earthworms → Watering → Harvesting
(C) Bed preparation → Harvesting → Site selection → Watering → Release of earthworms
(D) Watering → Site selection → Release of earthworms → Bed preparation → Harvesting

26. In vermicomposting, what is the ideal moisture level that must be maintained in the compost bed for the optimal growth of earthworms?
(A) 10-15%
(B) 30-40%
(C) 70-80%
(D) 90-100%

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27. The NADEP compost method was uniquely designed to emphasize which of the following principles?
(A) High consumption of cow dung combined with zero agricultural crop waste
(B) Efficient composting using minimal cow dung and maximum crop waste
(C) Large-scale production of compost under complete anaerobic underground conditions
(D) Absolute reliance on earthworm species without using any cow dung inputs

28. What are the standard dimensions of the brick tank required for the NADEP composting method?
(A) 5 ft length × 5 ft width × 5 ft height
(B) 10 ft length × 5 ft width × 3 ft height
(C) 12 ft length × 6 ft width × 2 ft height
(D) 8 ft length × 8 ft width × 4 ft height

29. Why is a honey-comb brick structure used for constructing a NADEP compost tank?
(A) To promote aeration for aerobic decomposition
(B) To effectively prevent external rainwater from entering the tank structure
(C) To allow the natural entry of soil earthworms from outside the pit
(D) To trap internal heat and cause spontaneous combustion of organic waste

30. Match the organic manure in List I with its approximate average Nitrogen content in List II.
List I: Organic Manure
P. Farm Yard Manure (FYM)
Q. Vermicompost
R. Poultry Manure
S. Groundnut Cake
List II: Nitrogen Content
1. 1.5 - 2.5 %
2. 0.5 %
3. 7.0 - 7.3 %
4. 3.03 %

(A) I, II, and III
(B) I, II, and IV
(C) II, III, and IV
(D) I, III, and IV

51. The primary purpose of using 'Super Seeder' or 'Happy Seeder' implements in standard agricultural practice is to:
(A) Sow seeds while simultaneously incorporating crop residue into soil
(B) Extract sugarcane juice efficiently from mature stalks during crushing operations
(C) Harvest underground tuber and root crops with minimal tuber damage
(D) Broadcast granular biofertilizers over large field areas aerially

52. Which of the following is a Potash Mobilizing Biofertilizer (KMB)?
(A) Rhizobium leguminosarum
(B) Azotobacter chroococcum
(C) Frateuria aurantia
(D) Trichoderma viride

53. Which green manure crop produces the highest green biomass per hectare if grown under optimum conditions?
(A) Sunhemp
(B) Cowpea
(C) Moong
(D) Guar

54. The process of Humification in the soil involves the formation of humus through the decomposition of:
(A) Synthetic fertilizers
(B) Rock phosphate
(C) Lime deposits
(D) Organic matter

55. Match the specialized equipment in a biofertilizer production unit in List I with its primary function in List II.
List I: Equipment
P. Autoclave
Q. Incubator
R. Fermenter
S. Laminar Air Flow
List II: Primary Function
1. Mass multiplication of bacterial broth
2. Providing a sterile environment for inoculation
3. Sterilization of growth media and glassware
4. Providing controlled temperature for microbial growth
(A) P-3, Q-4, R-1, S-2
(B) P-4, Q-3, R-2, S-1
(C) P-3, Q-1, R-4, S-2
(D) P-1, Q-2, R-3, S-4

56. Which chemical test is commonly used to determine the organic carbon content in soil, serving as an index of organic manure status?
(A) Kjeldahl Method
(B) Olsen's Method
(C) Walkley and Black Method
(D) Flame Photometry

57. Which type of composting process inherently generates significant heat (often reaching 60-70°C), which helps in killing weed seeds and pathogens?
(A) Purely anaerobic composting
(B) Vermicomposting
(C) BGA pond culture
(D) Aerobic composting

58. For effectively reducing sugarcane top borer and improving soil nutrient cycling simultaneously, a common integrated practice involves:
(A) Mulching cane trash between rows with Trichoderma/urea application
(B) Burning all crop residues and dry fallen leaves completely after harvest
(C) Continuous deep flooding of the field for a duration of sixty days
(D) Applying fresh raw cow dung directly over the exposed sett buds

59. When establishing a vermicompost unit, it is crucial to protect the beds from:
(A) Free ambient atmospheric nitrogen gas
(B) Direct sunlight and heavy rain
(C) Raw organic agricultural crop waste
(D) Naturally occurring microbial presence

60. Given below are two statements, one labelled as Assertion (A) and the other as Reason (R).
Assertion (A): Application of phosphatic fertilizer is highly recommended during the sowing of green manure crops like Sunhemp.
Reason (R): Phosphorus enhances root development, which promotes better nodulation and increased nitrogen fixation.
Select the correct answer from the options given below:
(A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.

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media and carrier materials.
II. A Laminar Air Flow chamber is used to ensure aseptic transfer of microbial cultures.
III. Biofertilizer production is entirely an open-air process requiring no temperature control.
Which of the above statement(s) is/are correct?
(A) I and II only
(B) II and III only
(C) I and III only
(D) I, II, and III

41. Which of the following materials is most commonly used as a 'carrier' in the production of carrier-based biofertilizers?
(A) Coarse river sand powder
(B) Fine clay mineral powder
(C) Decomposed wood sawdust
(D) Lignite powder

42. What is the standard recommended shelf life of carrier-based biofertilizers stored at normal room temperature?
(A) 1 month
(B) 6 months
(C) 2 years
(D) 5 years

43. Liquid biofertilizers are considered superior to carrier-based biofertilizers primarily because:
(A) They are significantly cheaper to transport and store in bulk containers
(B) They offer longer shelf life (12-24 months) and high temperature tolerance
(C) They act as fast-acting biopesticides that immediately kill soilborne pests
(D) They are completely sterile chemical formulations without any live bacteria

44. What is the recommended quantity of Farm Yard Manure (FYM) for commercial sugarcane cultivation under irrigated conditions?
(A) 1-2 tonnes per hectare
(B) 5-7 tonnes per hectare
(C) 15-20 tonnes per hectare
(D) 40-50 tonnes per hectare

45. Arrange the correct sequence for treating seeds with different agrochemicals and biofertilizers prior to sowing:
1. Treatment with Insecticide
2. Treatment with Fungicide
3. Treatment with Rhizobium/Biofertilizer
Choose the correct arrangement:
(A) 1, 2, 3
(B) 2, 1, 3
(C) 3, 2, 1
(D) 2, 3, 1

46. Gluconacetobacter diazotrophicus is an endophytic nitrogen-fixing biofertilizer exceptionally beneficial for which of the following commercial crops?
(A) Potato
(B) Cotton
(C) Sugarcane
(D) Mustard

47. Application of Acetobacter biofertilizer in sugarcane can typically save chemical nitrogen fertilizer up to what extent?
(A) 5 kg N/ha
(B) 25-30 kg N/ha
(C) 80-100 kg N/ha
(D) 150 kg N/ha

48. Quality standards, viable cell counts, and testing protocols for biofertilizers are legally governed under which order?
(A) The Seeds Act, 1966 and its associated statutory rules
(B) The Environment Protection Act, 1986 and amendment rules
(C) Fertilizer Control Order, 1985
(D) The Essential Commodities Act, 1955 and statutory orders

49. As per the Fertilizer Control Order (FCO) specifications, what is the minimum viable cell count required for a standard carrier-based biofertilizer (like Rhizobium or Azotobacter) at the time of manufacture?
(A) 1×10^4 CFU/g
(B) 5×10^7 CFU/g
(C) 1×10^{12} CFU/g
(D) 5×10^{15} CFU/g

50. Consider the following statements regarding the Paramparagat Krishi Vikas Yojana (PKVY):
I. It is a government scheme aimed at promoting organic farming.
II. Financial assistance is provided to farmers per hectare for three years.
III. It promotes organic farming exclusively through individual isolated farms, not clusters.
IV. It utilizes the Participatory Guarantee System (PGS) for organic certification.
Which of the above statement(s) is/are correct?

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(D) Free-living aerobic nitrogen-fixing bacterium

10. Given below are two statements, one labelled as Assertion (A) and the other as Reason (R).
Assertion (A): Azotobacter is widely used as a biofertilizer for cereal crops like wheat and maize.
Reason (R): Azotobacter forms root nodules in non-leguminous plants to fix atmospheric nitrogen.
Select the correct answer from the options given below:
(A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
(B) Both Assertion (A) and Reason (R) are true but R is not the correct explanation of A.
(C) Assertion (A) is true but Reason (R) is false.
(D) Assertion (A) is false but Reason (R) is true.

11. Azospirillum forms an associative symbiosis primarily with the root systems of which group of crops?
(A) Leguminous pulse and forage crops
(B) Graminaceous cereal and cash crops
(C) Oilseed crops like mustard and sesame
(D) Tuber crops like potato and cassava

12. Phosphate Solubilizing Bacteria (PSB) convert insoluble soil phosphorus into usable forms primarily through which mechanism?
(A) By physical breaking of soil aggregates
(B) By secreting organic acids that lower soil pH locally
(C) By absorbing phosphorus from the atmosphere
(D) By fixing atmospheric nitrogen which pushes phosphorus out

13. Which of the following microorganisms is widely used commercially as a Phosphate Solubilizing Biofertilizer?
(A) Bacillus megaterium
(B) Trichoderma harzianum
(C) Acetobacter diazotrophicus
(D) Nitrobacter

14. What does the term VAM stand for in the context of biofertilizers?
(A) Variable Aerobic Microorganism Culture
(B) Vital Amino Acid Plant Metabolite
(C) Vesicular Arbuscular Mycorrhiza
(D) Vascular Aquatic Moss Microplant

15. Consider the following statements regarding Mycorrhiza:
I. It is a symbiotic association between fungi and the roots of higher plants.
II. It predominantly increases the mobilization and uptake of soil phosphorus.
III. It decreases the plant's resistance to drought stress.
Which of the above statement(s) is/are correct?
(A) I and II only
(B) II and III only
(C) I and III only
(D) I, II, and III

16. Blue-Green Algae (BGA) is most effectively utilized as a biofertilizer in which of the following cropping systems?
(A) Rainfed wheat
(B) Spring planted sugarcane
(C) Lowland flooded paddy
(D) Dryland mustard

17. The nitrogen-fixing capacity of Blue-Green Algae (BGA) is highly dependent on its symbiotic association with which aquatic fern?
(A) Salvinia
(B) Azolla
(C) Lemna
(D) Marsilea

18. What is the standard application rate of Blue-Green Algae (BGA) culture recommended per hectare for a transplanted paddy field?
(A) 2 to 3 kg/ha
(B) 10 to 12 kg/ha
(C) 50 to 60 kg/ha
(D) 100 to 120 kg/ha

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19. What is the primary difference between standard compost and vermicompost?
(A) Vermicompost uses specific earthworm species to accelerate waste decomposition
(B) Standard compost requires synthetic chemicals whereas vermicompost uses pure organic inputs
(C) Standard compost is high in nitrogen while vermicompost contains exclusively potassium salts
(D) Vermicompost relies entirely on crushed animal bones and mineral limestone substrates

20. Consider the following statements regarding Farm Yard Manure (FYM):
I. Well-rotted FYM contains roughly 0.5% Nitrogen, 0.2% Phosphorus, and 0.5% Potassium.

(B) Both Assertion (A) and Reason (R) are true but R is not the correct explanation of A.
(C) Assertion (A) is true but Reason (R) is false.
(D) Assertion (A) is false but Reason (R) is true.

61. Nitrogen fixation inside the root nodules of leguminous plants by Rhizobium occurs under which specific biochemical condition?
(A) Microaerophilic conditions mediated by leghemoglobin
(B) High ambient oxygen concentration throughout the nodule cells
(C) Completely anaerobic conditions mediated by methane gas emission
(D) High light intensity conditions combined with high temperature

62. Which form of nitrogen is primarily absorbed by the sugarcane plant roots from the soil matrix?
(A) Free atmospheric elemental nitrogen gas (N_2)
(B) Intermediate soil nitrite ions (NO_2^-)
(C) Nitrate (NO_3^-) and Ammonium (NH_4^+)
(D) Volatile gaseous nitric oxide (NO)

63. Under the INM approach, if a soil test indicates a severe deficiency of Zinc in a sugarcane field, which of the following is the most appropriate recommendation?
(A) Apply heavy doses of Phosphorus to replace Zinc
(B) Spray liquid Rhizobium on the leaves
(C) Apply extra Urea as top dressing
(D) Apply 25 kg/ha of Zinc Sulphate as a basal dose

64. The efficiency of applied urea in paddy and sugarcane can be significantly increased by coating it with which organic material?
(A) Refined groundnut vegetable oil
(B) Commercial liquid kerosene oil
(C) Neem cake or neem oil
(D) Concentrated formaldehyde solution

65. Consider the following statements about compost preparation:
I. Maintaining a C:N ratio of around 30:1 provides an optimal diet for decomposing microbes.
II. Frequent turning of the compost heap ensures an adequate oxygen supply for aerobic bacteria.
III. Covering the compost heap with plastic prevents any internal heat generation.
Which of the above statement(s) is/are correct?
(A) I and II only
(B) II and III only
(C) I and III only
(D) I, II, and III

66. Identify the incorrect pair from the following regarding biofertilizer characteristics:
(A) Rhizobium – Specific to host crop
(B) Azotobacter – Non-symbiotic
(C) BGA – Phototrophic
(D) VAM – Ectomycorrhiza

67. The Participatory Guarantee System (PGS), utilized under various schemes in India, is primarily a mechanism for:
(A) Organic quality certification based on peer review
(B) Assuring minimum support price (MSP) for agricultural commodities
(C) Distributing subsidised chemical fertilizers equitably to farmers
(D) Guaranteeing assured irrigation water availability across regions

68. Which of the following non-edible oil cakes contains the highest percentage of nitrogen and is widely used as a concentrated organic manure?
(A) Processed Mahua seed cake
(B) De-oiled Neem seed cake
(C) Groundnut cake
(D) Decorticated Castor cake

69. Why is Mahua cake advised to be applied to the soil much earlier (around 2 months) than other oil cakes?
(A) Saponins in it delay nitrification and microbial decomposition
(B) It emits a distinct pleasant aromatic odour that requires extended time to settle
(C) It dissolves extremely fast in soil water causing rapid chemical nutrient leaching
(D) It volatilizes and evaporates rapidly into the atmosphere if applied near sowing time

70. Select the correct logical sequence of standard events in the process of obtaining formal Third-Party Organic Certification (like NPOP).
(A) Document Review → Application Submission → Field Inspection → Grant of Certificate
(B) Application Submission → Document Review → Field Inspection → Grant of Certificate
(C) Field Inspection → Application Submission

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→ Grant of Certificate → Document Review
(D) Grant of Certificate → Field Inspection → Document Review → Application Submission

71. In sugarcane cultivation, the practice of "Earthing up" is typically combined with the final top dressing of which major fertilizer to optimize INM?
(A) Granulated Single Super Phosphate
(B) Urea / Nitrogenous fertilizer
(C) Muriate of Potash fertilizer
(D) Micronutrient Zinc Sulphate powder

72. Which of the following is considered an indirect benefit of increasing Soil Organic Matter (SOM) through organic manuring?
(A) Total and immediate eradication of all soilborne fungal plant diseases
(B) Complete and permanent halt to deep soil water percolation losses
(C) Increase in soil Cation Exchange Capacity (CEC)
(D) Sudden drastic decrease in the overall soil buffering capacity values

73. Press mud, a byproduct of the sugar industry, is an excellent organic manure particularly rich in which nutrients?
(A) Nitrogen, Molybdenum, and Cobalt
(B) Potassium, Chlorine, and Sodium
(C) Sodium, Boron, and Iodine trace minerals
(D) Phosphorus, Calcium, and Sulphur

74. Match the crop in List I with the most appropriate biofertilizer commonly recommended for it in List II.
List I: Crop
P. Sugarcane
Q. Wheat
R. Paddy
S. Chickpea
List II: Biofertilizer
1. Azotobacter
2. Acetobacter
3. Rhizobium
4. Blue-Green Algae (BGA)
(A) P-2, Q-1, R-4, S-3
(B) P-1, Q-2, R-3, S-4
(C) P-4, Q-3, R-2, S-1
(D) P-2, Q-4, R-1, S-3

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75. A major limitation of using chemical fertilizers exclusively over many years without Integrated Nutrient Management is the loss of:
(A) Overall vertical root depth and root branching of crops
(B) Soil microbial biodiversity and health
(C) Upper leaf foliar structure and stomatal density
(D) Photosynthetic light availability and canopy absorption

76. To maximize the efficiency of applied urea and reduce volatilization losses in a field, which practice is recommended?
(A) Broadcasting urea uniformly over dry surface soil and leaving it fully exposed to air
(B) Split application of urea incorporated into moist soil
(C) Applying the entire seasonal requirement of urea in a single dose during seed sowing
(D) Dissolving the entire required quantity of urea directly into the main irrigation canal

77. Consider the following statements regarding the application of biofertilizers:
I. Chemical fertilizers and biofertilizers should be mixed together and stored for days before application.
II. Biofertilizer packets should be stored in a cool place away from direct sunlight.
III. Fungicide seed treatment should always precede biofertilizer application.
IV. Biofertilizers are crop-specific; Rhizobium for peas cannot be used for cereals.
Which of the above statement(s) is/are correct?
(A) I, II, and III
(B) II, III, and IV
(C) I, III, and IV
(D) I, II, and IV

78. Standard vermicompost maturity takes approximately how many days under optimal conditions of moisture and temperature?
(A) 10 - 15 days
(B) 60 - 90 days
(C) 150 - 180 days
(D) 200 - 250 days

79. Given below are two statements, one labelled as Assertion (A) and the other as Reason (R).
Assertion (A): Liquid biofertilizers are increasingly replacing carrier-based solid biofertilizers in modern agricultural recommendations.
Reason (R): Liquid formulations support a much

higher live cell count per unit volume and possess a longer shelf life without contamination risks.
Select the correct answer from the options given below:
(A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
(B) Both Assertion (A) and Reason (R) are true but R is not the correct explanation of A.
(C) Assertion (A) is true but Reason (R) is false.
(D) Assertion (A) is false but Reason (R) is true.

80. Consider the following statements regarding crop residue management:
I. Burning crop residue rapidly destroys soil beneficial microbes in the top layer.
II. Incorporating sugarcane trash into the soil improves organic carbon content over time.
III. Burning is legally promoted by the government to quickly clear fields for the next crop.
Which of the above statement(s) is/are correct?
(A) I and II only
(B) II and III only
(C) I and III only
(D) I, II, and III

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19. (A) Vermicompost uses specific earthworm species to accelerate waste decomposition
Standard composting relies on thermophilic microbial breakdown of organic waste over an extended duration, whereas vermicomposting utilizes specific epigeic earthworm species to ingest, digest, and bio-convert organic residues rapidly. The resulting vermicompost contains rich earthworm castings high in bioavailable plant nutrients, plant growth hormones, and beneficial microbial populations compared to conventional compost.

20. (B) I, II, and IV
Farm Yard Manure contains roughly 0.5 percent nitrogen, 0.2 percent phosphorus, and 0.5 percent potassium while significantly enhancing soil structural stability and water retention. Applying un-decomposed manure must be avoided because it attracts destructive pests like termites and causes nitrogen immobilization, whereas well-decomposed manure should be incorporated weeks prior to crop sowing.

21. (A) Dhaincha
Dhaincha is a fast-growing leguminous green manure crop exceptionally tolerant to soil salinity, alkalinity, and waterlogging conditions. Incorporating Dhaincha biomass into alkaline soils produces organic acids during decomposition, which neutralizes high soil pH, releases calcium to displace exchangeable sodium, and significantly restores physical and chemical properties of sodic soils.

22. (D) Sesbania aculeata
Sesbania aculeata, also known as Sesbania bispinosa, is the precise botanical name for Dhaincha. It is a soft-stemmed leguminous plant widely cultivated across tropical and subtropical regions for green manuring due to its rapid biomass accumulation, high nitrogen-fixing ability through root nodulation, and tolerance to adverse soil and moisture conditions.

23. (B) Pre-flowering to flowering stage
Green manure crops should be incorporated into the soil at the pre-flowering or early flowering stage, typically around 45 to 50 days after sowing. At this phase, the plant tissue is succulent, contains a low carbon-to-nitrogen ratio, and possesses maximum green biomass, enabling rapid decomposition and swift nutrient release.

24. (C) Eisenia fetida
Eisenia fetida, commonly known as the red worm or tiger worm, is an epigeic earthworm species globally preferred for commercial vermicomposting. It thrives in decaying organic waste, exhibits high moisture and temperature tolerance, possesses high reproductive rates, and rapidly converts organic residues into nutrient-rich castings under managed composting environments.

25. (B) Site selection → Bed preparation → Release of earthworms → Watering → Harvesting
Scientific vermicomposting begins with selecting a shaded, well-drained site, followed by constructing compost beds with organic waste layers. Earthworms are released into the prepared substrate, which is regularly watered to maintain optimal moisture levels. After complete organic degradation by earthworms, the final mature vermicompost is harvested, dried, and sieved for application.

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26. (B) 30-40%
Maintaining appropriate moisture levels within vermicompost beds is essential for earthworm respiration, feeding activity, and survival. An ideal moisture content of 30 to 40 percent should be maintained continuously. Excessively high moisture creates anaerobic conditions that harm worms, while low moisture dries out their moist skin, severely restricting metabolic functions.

27. (B) Efficient composting using minimal cow dung and maximum crop waste
The NADEP method of composting was developed by N. D. Pandharipande to produce large volumes of high-quality compost efficiently. Its primary design principle utilizes a minimal proportion of cow dung combined with large amounts of agricultural crop residues, farm weeds, and dry soil, optimizing aerobic microbial decomposition inside specialized above-ground brick enclosures.

28. (B) 10 ft length × 5 ft width × 3 ft height
The standard structural construction of a NADEP compost tank specifies dimensions of 10 feet in length, 5 feet in width, and 3 feet in height. These precise structural dimensions ensure adequate space for layering crop waste, soil, and slurry while maintaining ideal internal air circulation required for uniform aerobic decomposition.

without establishing structural associations with plant roots. In addition to nitrogen fixation, Azotobacter secretes beneficial growth-promoting substances such as auxins, gibberellins, and vitamins, which enhance root growth and seed germination across non-leguminous agricultural crops.

10. (C) Assertion (A) is true but Reason (R) is false.
Azotobacter is widely applied as an effective biofertilizer for cereal crops like wheat, maize, and rice to supplement nitrogen requirements. However, Azotobacter is a free-living microorganism that does not form root nodules or enter symbiotic structural partnerships with non-leguminous plants, relying instead on free-living nitrogen fixation within the rhizosphere environment.

11. (B) Graminaceous cereal and cash crops
Azospirillum forms an associative symbiotic relationship primarily with the roots of graminaceous plant species, including major cereal crops like sorghum, maize, pearl millet, and wheat, as well as cash crops like sugarcane. The bacteria colonize root surfaces and outer cortex regions, fixing atmospheric nitrogen and producing phytohormones that stimulate root development.

12. (B) By secreting organic acids that lower soil pH locally
Insoluble inorganic soil phosphorus complexes with calcium, iron, or aluminum depending on soil reaction. Phosphate Solubilizing Bacteria synthesize and excrete low molecular weight organic acids such as citric, oxalic, and gluconic acids. These organic acids lower the micro-environmental pH and chelate bound cations, releasing solubilized orthophosphate ions for root absorption.

13. (A) Bacillus megaterium
Bacillus megaterium strain var. phosphaticum is one of the most widely used bacterial species in commercial phosphate-solubilizing biofertilizer formulations. It actively secretes organic acids and phosphatases into the surrounding soil matrix, converting fixed or insoluble inorganic and organic phosphorus into bioavailable orthophosphate forms that crops can readily absorb through root systems.

14. (C) Vesicular Arbuscular Mycorrhiza
VAM stands for Vesicular Arbuscular Mycorrhiza, an endomycorrhizal fungal association formed between plant roots and soil fungi. The term refers to specialized structures formed within root cortical cells, namely vesicles for nutrient storage and highly branched arbuscles for nutrient exchange, which substantially increase plant uptake of immobile nutrients, especially phosphorus.

15. (A) I and II only
Mycorrhiza represents a mutualistic symbiotic association between specific soil fungi and plant roots that significantly enhances the uptake of immobile soil nutrients, particularly phosphorus. Furthermore, mycorrhizal colonization improves plant resistance against drought and osmotic stress by expanding the effective root absorptive surface area through extensive fungal hyphal networks spread across soil pores.

16. (C) Lowland flooded paddy
Blue-Green Algae, also known as Cyanobacteria, are photosynthetic nitrogen-fixing microorganisms that require moist or waterlogged conditions and solar radiation to grow effectively. Consequently, their biofertilizer application is ideally suited for lowland flooded paddy field environments, where they form floating mats, fix atmospheric nitrogen, and add organic matter upon decomposition.

17. (B) Azolla
Blue-Green Algae form a valuable symbiotic association with the small, free-floating freshwater fern Azolla. Specifically, the cyanobacterium Anabaena azollae resides within specialized leaf cavities of Azolla, where it fixes atmospheric nitrogen rapidly. This symbiotic dual system serves as an exceptional green manure and biofertilizer in flooded rice field production systems.

18. (B) 10 to 12 kg/ha
For effective nitrogen fixation in transplanted flooded rice cultivation, dried Blue-Green Algae flake culture is applied at a standard field rate of 10 to 12 kilograms per hectare. The culture is broadcast over standing water about a week after transplanting, establishing an algal mat that provides supplementary nitrogen to crops.

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mineral nutrients to enrich the soil ecosystem permanently.

39. (B) Nitrogen
Incorporating plant residues with a wide carbon-to-nitrogen ratio into soil stimulates rapid microbial proliferation. Decomposing microorganisms consume all available soluble mineral nitrogen from the soil matrix to build cellular protein, causing temporary nitrogen immobilization. Consequently, emerging crop seedlings experience acute nitrogen deficiency until decomposition completes and mineral nitrogen releases.

40. (A) I and II only
Producing quality biofertilizers requires specialized laboratory infrastructure under strict aseptic conditions. An autoclave sterilizes growth media and carrier substrates under high-pressure steam, while a Laminar Air Flow cabinet provides a sterile, filtered airflow environment during microbial culture inoculation, preventing contamination from unwanted airborne bacteria and fungal spores.

41. (D) Lignite powder
Lignite powder is the most widely utilized carrier material in solid carrier-based biofertilizer production. Highly neutralized, finely powdered lignite possesses high water-holding capacity, large specific surface area, non-toxic properties, and excellent chemical stability, which together support high population densities and survival of beneficial biofertilizer bacteria during storage and transport.

42. (B) 6 months
Standard solid carrier-based biofertilizers formulated with carrier substrates like lignite or peat have a recommended shelf life of six months from manufacturing when stored at ambient room temperature away from direct sunlight and moisture. Beyond this period, microbial viable cell populations decline below required standard regulatory limits.

43. (B) They offer longer shelf life (12-24 months) and high temperature tolerance
Liquid biofertilizer formulations offer substantial advantages over traditional carrier-based products. They maintain higher viable microbial counts, resist thermal stress, and possess an extended shelf life ranging from 12 to 24 months. Additionally, liquid formulations eliminate carrier contamination risks, simplify mechanical field application, and facilitate easier quality control testing.

44. (C) 15-20 tonnes per hectare
Under irrigated commercial sugarcane production, the standard recommended application rate for well-rotted Farm Yard Manure is 15 to 20 tonnes per hectare. Applying this organic manure during field preparation improves soil organic carbon, enhances soil water retention, optimizes soil physical structure, and increases the efficiency of applied chemical fertilizers.

45. (B) 2, 1, 3
Seed treatment follows a strict FIR sequence: Fungicide first, Insecticide second, and Rhizobium or biofertilizer last. Applying fungicides first protects seeds from fungal pathogens, followed by insecticide application. Microbial biofertilizers are applied final so that direct chemical contact is minimized, ensuring maximum survival of live bacterial cells on seeds.

46. (C) Sugarcane
Gluconacetobacter diazotrophicus, formerly Acetobacter diazotrophicus, is an endophytic nitrogen-fixing bacterium that lives within the vascular tissues, roots, stems, and leaves of sugar-rich crops like sugarcane. It fixes atmospheric nitrogen internally without forming external nodules and synthesizes plant growth-promoting hormones, making it exceptionally beneficial for sugarcane crop productivity.

NODIA

47. (B) 25-30 kg N/ha
Inoculating sugarcane setts or soil with Acetobacter biofertilizer provides supplementary nitrogen through internal endophytic nitrogen fixation. This biological process efficiently supplies available nitrogen to developing stalks, enabling farmers to reduce chemical nitrogen fertilizer application by approximately 25 to 30 kilograms of pure nitrogen per hectare without compromising yield.

48. (C) Fertilizer Control Order, 1985
Statutory regulations governing quality specifications, viable cell counts, permissible contamination thresholds, and standardized testing procedures for commercial biofertilizers and organic fertilizers in India are legally enforced under the Fertilizer Control Order, 1985. This

29. (A) To promote aeration for aerobic decomposition
NADEP composting tanks are constructed using brick masonry laid in a honeycomb pattern, leaving open rectangular gaps between bricks in vertical walls. This perforated wall design facilitates continuous passive aeration throughout the compost mass, supplying necessary atmospheric oxygen to aerobic microorganisms responsible for decomposing layered organic waste efficiently.

30. (A) P-2, Q-1, R-4, S-3
Farm Yard Manure contains roughly 0.5 percent nitrogen, while vermicompost averages 1.5 to 2.5 percent nitrogen. Poultry manure is a concentrated organic source containing approximately 3.03 percent nitrogen, and groundnut cake represents a highly concentrated organic manure yielding around 7.0 to 7.3 percent nitrogen upon breakdown in soil.

31. (D) Enhancing soil aggregation and water holding capacity
Regular applications of organic manures introduce organic matter that binds individual mineral particles into stable soil aggregates. This improves overall soil structure, enhances total pore space, decreases bulk density, and increases water filtration and retention capacities, thereby optimizing the physical micro-environment required for vigorous root growth and microbial activity.

32. (C) Jaggery (Gur) solution
When treating seeds with biofertilizer cultures, a ten percent jaggery or gur solution is commonly used as a natural sticky carrier adhesive. Boiling jaggery in water creates a cool, viscous liquid that ensures bacterial cells adhere uniformly to seed coats while providing easily accessible carbohydrates to nourish microflora during early germination.

33. (B) Mixing with fine soil or well-rotted FYM and broadcasting before sowing
When direct seed treatment is unfeasible, biofertilizers can be applied effectively via soil broadcasting. The carrier-based or liquid microbial culture is mixed thoroughly with moist, fine farm soil or well-rotted Farm Yard Manure and evenly broadcast across the field prior to sowing or transplanting, allowing beneficial microbes to colonize the rhizosphere.

34. (D) Sett treatment by dipping setts in biofertilizer solution before planting
In sugarcane farming, the standard recommended method for applying microbial biofertilizers such as Acetobacter or Phosphate Solubilizing Bacteria is sett treatment. Sugarcane stem setts are immersed in a prepared biofertilizer suspension for fifteen to thirty minutes before planting, allowing beneficial bacterial colonies to colonize cut ends and root primordia effectively.

35. (A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
Raw, undecomposed cow dung should never be applied directly to sugarcane fields. Microbes decomposing wide C:N ratio fresh dung consume available soil nitrogen, causing temporary crop nitrogen starvation. Furthermore, unfermented organic material attracts subterranean field pests like termites, which attack planted setts and young sugarcane shoots, causing significant crop loss.

36. (B) 25%
An effective Integrated Nutrient Management strategy in sugarcane cultivation aims to replace roughly 25 percent of the total recommended synthetic nitrogen dose using organic manures, green manuring, and specialized nitrogen-fixing biofertilizers. This substitution reduces chemical fertilizer input costs, minimizes environmental leaching, and maintains long-term soil health without sacrificing stalk yields.

37. (A) Decline in soil organic carbon and microbial activity
Continuous, exclusive application of synthetic chemical nitrogenous fertilizers like urea without organic carbon inputs severely degrades soil health over time. It accelerates organic matter depletion, lowers soil pH, damages soil structural aggregates, and reduces microbial populations and biological activity, ultimately causing soil compaction and declining overall fertilizer response efficiency.

NODIA

38. (D) Nitrogen
Burning crop residues in open fields causes atmospheric thermal losses of essential plant nutrients, particularly nitrogen and sulfur, which volatilize completely into gaseous compounds. Incorporating crop residues back into the soil conserves nitrogen within organic forms, returning valuable organic carbon and

ANSWERS

1. (B) To maintain long-term soil health and optimize crop productivity
Integrated Nutrient Management involves combining organic manures, biofertilizers, and chemical fertilizers in a balanced proportion. The main objective of this approach is to maintain long-term soil fertility and health while simultaneously optimizing crop yields. It prevents soil degradation, improves nutrient use efficiency, and reduces environmental hazards associated with exclusive chemical fertilizer reliance.

2. (D) Synthetic herbicides
Integrated Nutrient Management combines inorganic chemical fertilizers, organic manures, green manures, and microbial biofertilizers to nourish crops sustainably. Synthetic herbicides are chemical plant protection agents used specifically for controlling unwanted weed populations in agricultural fields and do not supply essential plant nutrients or contribute directly to soil fertility and plant nutrition strategies.

3. (A) Improving soil organic carbon and nutrient use efficiency
Applying organic manures along with inorganic chemical fertilizers in sugarcane crops enhances soil organic matter and improves physical soil attributes like structure and water retention. This synergistic combination increases overall microbial activity and optimizes nutrient uptake efficiency, preventing leaching losses of applied chemical inputs while enhancing soil organic carbon levels over time.

4. (C) A preparation containing live or latent cells of efficient microbial strains
A biofertilizer is a substance containing live or latent cells of beneficial microorganisms such as bacteria, fungi, or algae. When applied to seeds, plant surfaces, or soil, these microorganisms colonize the rhizosphere or interior of the plant and promote growth by increasing the supply or availability of primary nutrients to the host.

5. (A) P-3, Q-2, R-4, S-1
Rhizobium forms a symbiotic nitrogen-fixing association with pulse roots, whereas Azotobacter acts as a free-living aerobic nitrogen-fixing bacterium in non-legumes. Vesicular Arbuscular Mycorrhiza extends hyphae into soil pores to enhance phosphorus absorption, and Pseudomonas striata operates as an effective phosphate-solubilizing bacterium converting insoluble soil phosphorus into plant-available ionic forms.

6. (D) Rhizobium
Rhizobium bacteria establish a highly specific symbiotic relationship with leguminous pulse crops by forming specialized root nodules. Within these nodules, the bacteria convert atmospheric nitrogen gas into plant-available ammonium forms using the nitrogenase enzyme complex, thereby drastically reducing the need for synthetic nitrogenous fertilizer applications in pulse crop production systems.

7. (B) 200 grams
Seed inoculation with biofertilizers requires precise application standards to ensure high microbial density on the seed surface. The standard recommended rate of carrier-based Rhizobium culture is 200 grams for treating ten kilograms of pulse seeds. This dosage ensures sufficient bacterial population to establish effective nodulation and nitrogen fixation upon seedling germination.

8. (C) Rhizobium japonicum
Nitrogen fixation in legumes depends on species-specific bacterial compatibility with the host plant. Rhizobium japonicum, also classified as Bradyrhizobium japonicum, is the specialized bacterial species required for efficient root nodulation and atmospheric nitrogen fixation in soybean crops. Using non-specific strains results in ineffective nodule formation and poor nitrogen fixation capabilities.

9. (D) Free-living aerobic nitrogen-fixing bacterium
Azotobacter is a non-symbiotic, free-living, heterotrophic, aerobic soil bacterium capable of fixing atmospheric nitrogen independently

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regulatory order ensures biofertilizers sold to farmers satisfy mandatory physical, chemical, and biological criteria.

49. (B) 5×10^7 CFU/g
Under the Indian Fertilizer Control Order specifications, carrier-based biofertilizers such as Rhizobium, Azotobacter, and Azospirillum must maintain a minimum viable cell count of 5×10^7 colony forming units per gram of carrier material at the time of manufacture. This ensures sufficient microbial density for establishing effective field inoculation.

50. (B) I, II, and IV
Paramparagat Krishi Vikas Yojana promotes cluster-based organic farming across agricultural landscapes. Financial support is provided per hectare over three years to cover organic inputs, certification, and marketing costs. Certification is institutionalized through the Participatory Guarantee System, a peer-review organic guarantee process designed specifically for local farmer groups operating within clusters.

51. (A) Sow seeds while simultaneously incorporating crop residue into soil
Super Seeders and Happy Seeders are advanced conservation agricultural implements designed to manage heavy crop residues like paddy stubble without open field burning. These tractor-drawn machines cut and deposit crop residue as surface mulch while simultaneously drilling seeds and applying fertilizers directly into soil in a single field operation.

52. (C) Frateuria aurantia
Frateuria aurantia is a widely recognized potassium-mobilizing bacterium used as a biofertilizer. It secretes organic acids that solubilize fixed, insoluble soil potassium minerals such as mica and feldspar, converting bound potassium into bioavailable ionic forms that plant root systems can absorb efficiently, reducing reliance on commercial potassic chemical fertilizers.

53. (A) Sunhemp
Sunhemp, botanically known as Crotalaria juncea, produces the highest green biomass yield per hectare among common green manure crops under optimal growth conditions. Within 45 to 60 days of growth, it generates substantial succulent organic matter high in nitrogen, which decomposes rapidly upon soil incorporation to enrich fertility.

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54. (D) Organic matter
Humification is the complex biochemical process wherein soil microorganisms decompose plant and animal organic residues into dark, amorphous, highly stable organic substances called humus. Humus improves soil aggregation, enhances cation exchange capacity, increases moisture retention, and acts as a long-term reservoir for essential plant nutrients within agricultural soils.

55. (A) P-3, Q-4, R-1, S-2
An autoclave uses high-pressure steam to sterilize media and glassware, while incubators provide controlled temperature environments for culturing microbes. Fermenters allow industrial-scale liquid mass multiplication of bacterial broths, and Laminar Air Flow workstations provide clean, sterile laminar air environments for aseptic culture transfers and laboratory inoculations.

56. (C) Walkley and Black Method
The Walkley and Black rapid dichromate oxidation method is the standard laboratory analytical technique used to determine organic carbon content in soil. Because soil organic carbon correlates directly with soil organic matter, this test serves as a primary index for evaluating soil fertility status and organic manure requirements.

57. (D) Aerobic composting
Aerobic composting involves thermophilic micro-organisms decomposing organic waste in the presence of oxygen, generating significant metabolic heat that elevates pile temperatures to 60–70°C. This natural thermal pasteurization effectively pasteurizes human and plant pathogens, destroys weed seeds, and eliminates vector larvae, yielding a safe, stable compost product.

58. (A) Mulching cane trash between rows with Trichoderma/urea application
Retaining sugarcane trash between crop rows as mulch combined with Trichoderma fungal inoculants and urea application accelerates residue decomposition, suppresses weed growth, and conserves soil moisture. Concurrently, this cultural practices breaks the lifecycle of top borers and egg parasitoids, integrating insect

smell, signaling complete biological stabilization of ingested organic residues.

79. (A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
Liquid biofertilizers are increasingly preferred over traditional solid carrier formulations because they contain substantially higher living bacterial populations per milliliter. Liquid media protect microbes from desiccation and thermal stress, extending shelf life up to two years while eliminating carrier contamination and facilitating easy application through modern irrigation equipment.

80. (A) I and II only
Burning crop residue generates extreme surface heat that kills beneficial soil organisms and destroys topsoil organic matter. In contrast, incorporating sugarcane trash and crop residues into soil enriches soil organic carbon, improves soil physical structure, and conserves nutrients, which is why residue burning is discouraged and legally restricted across agricultural regions.

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decomposing rapidly in moist soil through microbial mineralization to release plant-available nutrients for crop uptake.

69. (A) Saponins in it delay nitrification and microbial decomposition
Mahua seed cake contains naturally occurring toxic glucosides called saponins, which inhibit soil microbial activity and significantly slow down initial decomposition and nitrification rates. Applying Mahua cake nearly two months prior to crop sowing allows sufficient time for saponins to degrade, enabling timely nutrient release for growing plants.

70. (B) Application Submission → Document Review → Field Inspection → Grant of Certificate
Official third-party organic certification under systems like NPOP follows an established sequential workflow. The process begins with submitting a formal application, followed by desktop document review by certification bodies. Authorized inspectors then conduct physical field inspections, evaluate soil and crop management practices, and ultimately grant organic certification if compliant.

71. (B) Urea / Nitrogenous fertilizer
Earthing up in sugarcane involves mounding soil around plant bases to provide structural support against lodging. This field operation is combined with applying the final split dose of nitrogenous fertilizer like urea, effectively placing nutrients near root zones and covering them with soil to reduce nitrogen losses from volatilization.

72. (C) Increase in soil Cation Exchange Capacity (CEC)
Increasing Soil Organic Matter through regular organic manuring significantly boosts soil Cation Exchange Capacity. Humus and organic compounds provide numerous negatively charged exchange sites that bind essential nutrient cations like calcium, magnesium, and potassium, preventing nutrient leaching and enhancing soil nutrient retention and availability for plant roots.

73. (D) Phosphorus, Calcium, and Sulphur
Press mud, also called filter cake, is an organic sugar industry byproduct produced during cane juice clarification. It serves as an excellent organic soil amendment exceptionally rich in phosphorus, calcium, and sulfur, alongside organic matter, helping improve soil fertility, structure, and chemical properties in degraded or nutrient-deficient agricultural soils.

74. (A) P-2, Q-1, R-4, S-3
Acetobacter is an endophytic biofertilizer widely recommended for sugarcane, while Azotobacter supplies nitrogen to cereal crops like wheat. Blue-Green Algae thrive in flooded paddy fields fixing nitrogen photosynthetically, and Rhizobium specifically infects leguminous pulses like chickpea to establish symbiotic nitrogen-fixing root nodules in host crop root systems.

75. (B) Soil microbial biodiversity and health
Relying exclusively on synthetic chemical fertilizers without incorporating organic manures leads to long-term deterioration of soil biological health. Chemical inputs fail to supply organic carbon required as an energy substrate by beneficial soil microorganisms, eventually reducing microbial populations, diversity, enzyme activities, and natural biological nutrient cycling mechanisms within soil ecosystems.

76. (B) Split application of urea incorporated into moist soil
Maximizing urea fertilizer efficiency requires applying it in multiple split doses incorporated directly into moist soil rather than broadcasting on dry surfaces. Soil incorporation places nitrogen near active root zones and shields ammonium ions from surface exposure, significantly reducing ammonia volatilization, surface runoff, and deep nitrate leaching losses.

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77. (B) II, III, and IV
Biofertilizer packets contain live micro-organisms requiring shaded, cool storage away from direct sunlight. When treating seeds with chemicals and biologicals, fungicides must be applied prior to biofertilizer inoculation. Mixing chemical fertilizers directly with live microbial biofertilizers damages viable bacterial cells and must strictly be avoided to maintain product efficacy.

78. (B) 60 - 90 days
Under optimum conditions of substrate moisture, shade, aeration, and ambient temperature, earthworms process organic waste into mature vermicompost within 60 to 90 days. The finished product appears dark brown, lightweight, granular, and soil-like, possessing a rich earthy

pest management directly with soil nutrient enhancement.

59. (B) Direct sunlight and heavy rain
Vermicompost beds must be protected from exposure to direct sunlight and heavy rainfall. Excessive heat and ultraviolet radiation from sunlight dry out substrate beds and kill temperature-sensitive earthworm populations, whereas torrential rainfall causes waterlogging, depletes bed oxygen, and leads to earthworm mortality or mass migration away from composting units.

60. (A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
Applying phosphatic fertilizers like Single Super Phosphate during green manure sowing is strongly recommended. Phosphorus stimulates early root elongation and extensive root lateral branching, which enhances nodule formation and colonization by Rhizobium. This increased root nodulation directly boosts biological nitrogen fixation and total green manure biomass accumulation.

61. (A) Microaerophilic conditions mediated by leghemoglobin
Biological nitrogen fixation by Rhizobium inside legume root nodules relies on the nitrogenase enzyme complex, which is irreversibly inactivated by free oxygen. Leghemoglobin regulates oxygen diffusion, maintaining precise microaerophilic conditions. This provides low oxygen concentrations necessary for bacterial ATP synthesis without inhibiting nitrogenase enzyme function during nitrogen conversion.

62. (C) Nitrate (NO3-) and Ammonium (NH4+)
Sugarcane plant roots absorb dissolved nitrogen from the soil solution primarily in two ionic forms: nitrate anions and ammonium cations. In well-aerated unsaturated agricultural soils, nitrifying bacteria rapidly convert ammonium into nitrate, making nitrate the predominant form absorbed, although ammonium is readily utilized in submerged or anaerobic soil environments.

63. (D) Apply 25 kg/ha of Zinc Sulphate as a basal dose
Zinc is an essential micronutrient vital for enzyme activation and auxin synthesis in sugarcane. When soil testing reveals acute zinc deficiency, applying 25 kilograms per hectare of zinc sulphate as a soil basal dose during land preparation corrects the shortfall, restoring normal growth, internodal elongation, and photosynthetic leaf development.

64. (C) Neem cake or neem oil
Coating commercial urea granules with neem cake or neem oil inhibits nitrifying bacteria in soil, slowing the conversion of ammonium to volatile nitrate forms. This slow-release mechanism significantly reduces nitrogen leaching and denitrification losses in paddy and sugarcane crops, enhancing overall nitrogen use efficiency and crop uptake.

65. (A) I and II only
Composting relies on balancing carbon for microbial energy and nitrogen for protein synthesis, with a 30:1 C:N ratio providing optimal conditions. Frequent heap turning introduces vital oxygen to maintain aerobic decomposition, whereas covering heaps tightly with plastic restricts air movement, creating undesirable anaerobic conditions and foul odors.

66. (D) VAM – Ectomycorrhiza
Vesicular Arbuscular Mycorrhiza is classified as an endomycorrhiza, not an ectomycorrhiza. VAM fungal hyphae penetrate root cortical cell walls to form characteristic internal arbuscles and vesicles for nutrient exchange, whereas ectomycorrhizal fungi form external mantle sheaths around root tips without intracellular wall penetration, commonly associated with forest trees.

67. (A) Organic quality certification based on peer review
The Participatory Guarantee System is a locally focused organic quality assurance framework that certifies agricultural producers through peer review. It operates on active participation, trust, and shared knowledge among local farmers and consumers, providing a simplified, cost-effective alternative to expensive third-party certification for smallholder farmers pursuing organic production.

68. (C) Groundnut cake
Groundnut cake is a highly valuable organic manure containing roughly 7.0 to 7.3 percent nitrogen, along with essential phosphorus and potassium. It represents one of the richest concentrated organic nitrogen sources,

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CHAPTER 16

Soil Microbiology and Soil Conservation

1. Who is widely considered the father of soil microbiology for his pioneering work on autotrophic bacteria and nitrogen fixation?
(A) Selman Waksman
(B) Martinus Beijerinck
(C) Sergei Winogradsky
(D) Louis Pasteur

2. Which group of soil microorganisms generally possesses the highest overall biomass per hectare in normal agricultural soils?
(A) Bacteria
(B) Fungi
(C) Actinomycetes
(D) Algae

3. In flooded rice fields, which microorganism plays a critical natural role in fixing atmospheric nitrogen?
(A) Free-living Azotobacter bacteria
(B) Symbiotic Rhizobium bacteria
(C) Actinomycetal Frankia species
(D) Cyanobacteria

4. The characteristic earthy smell of freshly ploughed soil after the first rain is primarily due to the compound geosmin produced by which microbes?
(A) Actinomycetes
(B) Soil protozoa
(C) Soil fungi
(D) Soil bacteria

5. Consider the following statements regarding biological nitrogen fixation:
I. Rhizobium forms a symbiotic association specifically with legume roots.
II. Azotobacter is a symbiotic nitrogen fixer found in wheat roots.
III. Frankia fixes nitrogen symbiotically in non-leguminous plants like Casuarina.
Which of the above statements is/are correct?
(A) I and II only
(B) I and III only
(C) II and III only
(D) I, II and III

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6. The biological process where soil ammonia is converted into nitrite and subsequently into nitrate by specific soil bacteria is known as:
(A) Nitrification
(B) Denitrification
(C) Ammonification
(D) Nitrogen immobilization

7. Which of the following bacterial genera is primarily responsible for denitrification in waterlogged soils, causing the loss of plant-available nitrogen?
(A) Azospirillum
(B) Rhizobium
(C) Nitrosomonas
(D) Pseudomonas

8. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): Nitrogenase enzyme functions efficiently in the presence of high oxygen levels.
Reason (R): Leghemoglobin scavenges oxygen in root nodules to protect the nitrogenase enzyme.
Which of the following is correct?
(A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
(B) Both Assertion (A) and Reason (R) are true but R is not the correct explanation of A.
(C) Assertion (A) is true but Reason (R) is false.
(D) Assertion (A) is false but Reason (R) is true.

9. Match the soil microorganisms in List I with their primary role in the nitrogen cycle in List II.
List I: Soil Microorganisms
P. Nitrosomonas
Q. Nitrobacter
R. Azotobacter
S. Rhizobium
List II: Role in Nitrogen Cycle
1. Free-living nitrogen fixation
2. Symbiotic nitrogen fixation
3. Conversion of Ammonia to Nitrite
4. Conversion of Nitrite to Nitrate
(A) P-3, Q-4, R-1, S-2
(B) P-4, Q-3, R-1, S-2

(A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
(B) Both Assertion (A) and Reason (R) are true but R is not the correct explanation of A.
(C) Assertion (A) is true but Reason (R) is false.
(D) Assertion (A) is false but Reason (R) is true.

29. Which of the following deep-rooted perennial grasses is extensively used for the biological engineering of earthen bunds and gully control?
(A) Parthenium hysterophorus
(B) Chrysopogon zizanioides
(C) Saccharum spontaneum
(D) Echinochloa crus-galli

30. To provide maximum aerodynamic protection against wind erosion, a multi-row tree shelterbelt should ideally be planted in a geometric shape resembling a:
(A) Triangular shape
(B) Flat rectangular shape
(C) Inverted conical shape
(D) Hollow square

31. Match the soil conservation measures in List I with their appropriate slope suitability in List II.
List I: Soil Conservation Measures
P. Agronomic measures
Q. Contour bunding
R. Graded bunding
S. Bench terracing
List II: Slope Suitability
1. Slopes from 16 to 33%
2. Slopes less than 2%
3. Low rainfall areas up to 6% slope
4. High rainfall areas with 2-10% slope
(A) P-2, Q-3, R-4, S-1
(B) P-3, Q-4, R-1, S-2
(C) P-2, Q-4, R-3, S-1
(D) P-1, Q-2, R-3, S-4

32. The agronomic practice of growing erosion-permitting crops and erosion-resisting crops in alternating parallel bands across the slope is called:
(A) Traditional intercropping systems
(B) Sequential relay cropping method
(C) Protective cover cropping method
(D) Contour strip cropping

33. What is the primary function of planting a "cover crop" in a soil conservation farming system?
(A) To increase the cash income of the farmer during the harsh winter off-season
(B) To act as a biological trap crop for migrating stem borer insects in crops
(C) To cover the soil surface and prevent wind and water erosion
(D) To rapidly increase the overall base saturation level of severely sodic soils

34. Consider the following statements about adopting a crop rotation for soil health improvement:
I. Including deep-rooted crops after shallow-rooted crops ensures uniform nutrient extraction from different soil profiles.
II. Leguminous crops in a rotation deplete soil nitrogen reserves more rapidly than cereals.
III. Crop rotation helps in breaking the lifecycle of soil-borne pests and diseases.
Which of the above statements is/are correct?
(A) I and II only
(B) I and III only
(C) II and III only
(D) I, II and III

35. A higher diversity in the soil microbiome directly contributes to which vital long-term aspect of soil health?
(A) Increased soil bulk density and severe structural compaction
(B) Higher incidence of persistent soil-borne diseases in crops
(C) Permanent reduction in the soil's total moisture holding capacity
(D) Enhanced ecological resilience and nutrient cycling

36. Which structural soil moisture conservation technique involves covering the bare soil surface with crop residues, plastic sheets, or organic matter to cut down evaporation?
(A) Mulching
(B) Subsoiling
(C) Earthing up
(D) Puddling

37. In the construction of farm ponds for surface runoff harvesting, which material is most commonly used as a bottom lining to prevent excessive seepage loss?
(A) Agricultural grade Gypsum powder
(B) Crushed mineral Iron Pyrite
(C) Bentonite clay
(D) Hydrated Slaked lime

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(B) P-3, Q-4, R-1, S-2
(C) P-4, Q-2, R-3, S-1
(D) P-2, Q-3, R-4, S-1

20. Under the standard Soil Health Card (SHC) scheme, what is the standard grid size for collecting composite soil samples in irrigated agricultural areas?
(A) 1.0 hectare
(B) 2.5 hectares
(C) 5.0 hectares
(D) 10.0 hectares

21. Consider the following statements regarding precautions to be taken during soil sampling:
I. Standing crop rows and active fertilizer bands must be avoided while drawing a sample.
II. The soil sample should be dried in direct, intense sunlight before packing to speed up the process.
III. V-shaped cuts should be made to collect soil uniformly from the top to the bottom of the plough layer.
Which of the above statements is/are correct?
(A) I and II only
(B) I and III only
(C) II and III only
(D) I, II and III

22. In the Land Capability Classification system, Class I land representing the most productive and least restricted arable land is standardly represented by which map color code?
(A) Green
(B) Red
(C) Yellow
(D) Blue

23. The initial detachment and airborne movement of small soil particles caused directly by the kinetic energy of falling raindrops is technically known as:
(A) Sheet erosion process
(B) Rill erosion process
(C) Gully erosion process
(D) Splash erosion

24. Arrange the following steps of composite soil sampling and preparation in the correct procedural order:
1. Grinding the soil with a wooden mortar and pestle
2. Drying the collected soil sample in the shade
3. Sieving the ground soil through a 2 mm mesh sieve
4. Quartering the bulk field sample to reduce its volume to about 500 grams
Select the correct order:
(A) 2, 4, 1, 3
(B) 4, 2, 3, 1
(C) 2, 1, 4, 3
(D) 4, 1, 3, 2

25. Which mechanism of wind erosion accounts for the greatest percentage (often 50 to 75 percent) of soil particle movement in arid and semi-arid regions?
(A) Surface creep
(B) Suspension
(C) Saltation
(D) Leaching

26. Agronomic measures of soil conservation (such as contour farming and mulching) are generally most effective and recommended for lands where the slope is less than:
(A) 2 percent
(B) 6 percent
(C) 10 percent
(D) 15 percent

27. Consider the following statements about mechanical measures of soil conservation:
I. Contour bunding is highly suitable for low rainfall areas and highly permeable soils.
II. Graded bunding is recommended for high rainfall areas exceeding 600 mm per year.
III. Bench terracing is strictly practiced on flat lands with less than 2% slope.
IV. Zingg terracing involves dividing the land into a contributing area and a levelled receiving area.
Which of the above statements are correct?
(A) I, II and III
(B) I, II and IV
(C) II, III and IV
(D) I, III and IV

28. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): Bench terracing involves converting steep sloping lands into a series of step-like level platforms.
Reason (R): It is recommended for lands having a gentle slope of 1 to 2 percent.
Which of the following is correct?

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heavy metal pollutants from contaminated soils is called:
(A) Phytoremediation
(B) Bioleaching
(C) Biomagnification
(D) Eutrophication

47. Consider the following statements regarding the effects of industrial and chemical pollution on soil biology:
I. Excessive use of chemical pesticides stimulates the uncontrolled growth of all soil fungi.
II. Toxic heavy metals like Cadmium severely inhibit critical soil enzyme activities.
III. Acidic industrial effluents can drastically alter soil pH, negatively affecting microbial populations.
Which of the above statements is/are correct?
(A) I and II only
(B) I and III only
(C) II and III only
(D) I, II and III

48. The sustainable soil management strategy that explicitly advocates using chemical fertilizers in strict conjunction with organic manures and biofertilizers is known as:
(A) Zero Budget Natural Farming system
(B) Sustainable Conservation Agriculture
(C) High-tech Precision Farming system
(D) Integrated Nutrient Management

49. Which endophytic nitrogen-fixing bacterium is uniquely known to inhabit the interior tissues of sugarcane plants and supply them with atmospheric nitrogen?
(A) Insecticidal Bacillus thuringiensis
(B) Symbiotic Bradyrhizobium japonicum
(C) Gluconacetobacter diazotrophicus
(D) Biocontrol Pseudomonas fluorescens

50. Most symbiotic nitrogen-fixing bacteria require metabolic energy from the host plant. In return, they convert atmospheric nitrogen (N_2) into which usable form?
(A) Nitrogen gas (N_2)
(B) Ammonia (NH3)
(C) Nitrous oxide (N_2O)
(D) Nitric acid (HNO3)

51. Certain soil microorganisms, particularly fungi, excrete a sticky glycoprotein that acts as a super-glue to bind soil particles into stable aggregates. What is it called?
(A) Plant Lignin
(B) Plant Suberin
(C) Plant Cutin
(D) Glomalin

52. In the Universal Soil Loss Equation (USLE), represented by the formula $A = R \times K \times L \times S \times C \times P$, what does the factor 'K' specifically stand for?
(A) Soil Erodibility Factor
(B) Rainfall Erosivity Factor
(C) Topographic Factor
(D) Crop Management Factor

53. Temporary mechanical structures made of stones, brushwood, or logs used to effectively reduce the velocity of water in deep drainage channels are known as:
(A) Contour bunds
(B) Bench terraces
(C) Check dams
(D) Broad bed furrows

54. To achieve the maximum protective effect, an agricultural windbreak should be planted in which direction relative to the prevailing erosive winds?
(A) Directly parallel to the prevailing wind direction
(B) At an acute 45-degree angle to the wind direction
(C) Perpendicular to the wind direction
(D) In a full circular pattern enclosing individual trees

55. The basic principle of contour farming is to perform primary tillage operations and sow crops:
(A) Straight up and down along the slope of the land
(B) Across the slope along elevation contour lines
(C) In a spiral pattern starting from the center of the field
(D) Parallel to the nearest natural river or stream

56. In a crop rotation sequence designed to improve soil health, why is it agronomically recommended to follow a shallow-rooted cereal crop with a deep-rooted legume crop?
(A) The legume crop physically prevents the

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38. Select the correct sequential order of the successive stages of water erosion on agricultural land:
(A) Splash erosion → Sheet erosion → Rill erosion → Gully erosion
(B) Sheet erosion → Splash erosion → Gully erosion → Rill erosion
(C) Rill erosion → Splash erosion → Sheet erosion → Gully erosion
(D) Gully erosion → Rill erosion → Sheet erosion → Splash erosion

39. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): Sheet erosion is often called the "death of the farmer".
Reason (R): It uniformly removes the most fertile topsoil layer without being easily noticed until crop yields decline.
Which of the following is correct?
(A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
(B) Both Assertion (A) and Reason (R) are true but R is not the correct explanation of A.
(C) Assertion (A) is true but Reason (R) is false.
(D) Assertion (A) is false but Reason (R) is true.

40. Extensive areas of Usar (sodic) lands have been successfully reclaimed for agriculture using which chemical soil amendment?
(A) Calcium carbonate
(B) Gypsum
(C) Sodium chloride
(D) Potassium sulphate

41. Consider the following statements about land use planning:
I. Land capability classification determines the suitability of land for various broad uses.
II. Classes I to IV lands are generally suited for sustained agricultural cultivation.
III. Class VIII lands are considered the most ideal for intensive mechanized agriculture.
IV. A watershed is frequently designated as the basic operational unit for land use planning.
Which of the above statements are correct?
(A) I, II and III
(B) I, II and IV
(C) II, III and IV
(D) I, III and IV

42. What is the core objective of the central government's PM-PRANAM scheme launched to improve long-term soil sustainability?
(A) To provide direct financial cash transfers to farmers specifically for buying certified crop seeds
(B) To supply completely free solar irrigation pumps to all small and marginal sugarcane growers
(C) To mechanically map all agricultural lands across states using advanced drone technology
(D) To promote balanced fertilizer use and alternative nutrients

43. Earthworms play an incredibly crucial role in soil health through a process called 'bioturbation'. What does this ecological term refer to?
(A) Physical mixing and aeration of soil profiles
(B) The enzymatic breakdown of persistent chemical pesticides
(C) The biological fixation of atmospheric nitrogen into ammonia
(D) The infection of plant roots by symbiotic mycorrhizal fungi

44. Match the agricultural schemes in List I with their primary objective in List II.
List I: Agricultural Schemes
P. Paramparagat Krishi Vikas Yojana (PKVY)
Q. PM Krishi Sinchayee Yojana (PMKSY)
R. Soil Health Card Scheme (SHC)
S. PM-PRANAM
List II: Primary Objective
1. Promotion of alternative nutrients
2. Nutrient status assessment and recommendations
3. Promotion of organic farming
4. Improving field water use efficiency
(A) P-3, Q-4, R-2, S-1
(B) P-4, Q-3, R-1, S-2
(C) P-2, Q-1, R-4, S-3
(D) P-3, Q-2, R-4, S-1

45. The long-term application of untreated industrial effluents to agricultural soils primarily leads to the toxic accumulation of:
(A) Complex carbohydrates and starches
(B) Heavy metals
(C) Essential amino acids
(D) Beneficial nitrifying bacteria

46. The scientific biological technique that utilizes living plants to extract, sequester, or detoxify

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(B) Flooding the field continuously for two months
(C) Deep digging up to 2 meters around the clumps
(D) Trash mulching between cane rows

68. In sugar production, sugar mills produce a dark by-product that serves as an excellent organic soil amendment rich in calcium, sulphur, and organic matter. What is it?
(A) Pressmud
(B) Sugarcane Bagasse
(C) Heavy Molasses
(D) Industrial Ethanol

69. Which central government agricultural scheme has the core motto "Har Khet Ko Pani", focusing on expanding cultivable area under assured irrigation and checking runoff?
(A) Rashtriya Krishi Vikas Yojana - Remunerative Approaches
(B) Pradhan Mantri Fasal Bima Crop Insurance Scheme
(C) Pradhan Mantri Krishi Sinchayee Yojana
(D) National Food Security Mission for Sustainable Agriculture

70. Which premier research institute of the ICAR focuses on standardizing technologies for the physical and chemical reclamation of salt-affected (Usar) lands?
(A) Central Soil Salinity Research Institute, Karnal
(B) ICAR - Indian Institute of Sugarcane Research, Lucknow
(C) ICAR - Central Arid Zone Research Institute, Jodhpur
(D) ICAR - Indian Institute of Soil Science, Bhopal

71. The maximum acceptable rate of soil erosion that allows crop productivity to be sustained economically and indefinitely without soil degradation is termed the:
(A) Runoff coefficient
(B) Soil erodibility limit
(C) Universal erosion rate
(D) Permissible soil loss

72. Tillage physically manipulates the soil profile. Immediately after a deep primary ploughing operation, what happens to the soil's bulk density?
(A) It increases significantly due to rapid soil compaction
(B) It decreases due to increased pore space
(C) It remains exactly the same as undisturbed native soil
(D) It drops immediately down to an absolute zero value

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73. For optimal biological decomposition of organic matter in the soil, the ideal soil moisture content should be maintained near:
(A) The permanent wilting point
(B) Total saturation (waterlogged state)
(C) Field capacity
(D) The oven-dry state

74. Humus has heavily charged colloidal surfaces. This physical property directly provides the agricultural soil with a high:
(A) High overall leaching potential
(B) Soil thermal conductivity value
(C) Total sand content equivalent
(D) Cation Exchange Capacity

75. When preparing a soil sample for laboratory testing, why is it strictly advised NOT to collect or transport the sample in empty chemical fertilizer bags?
(A) Residual chemicals will contaminate the sample and alter test results
(B) They rapidly absorb all moisture from the soil sample and alter its physical texture
(C) They cause the sample to heat up drastically and burn off essential organic carbon
(D) The plastic bags are highly transparent to sunlight which destroys beneficial bacteria

76. In the standard Land Capability Classification system, if a land class is denoted with the subclass 'e' (for example, Class IIe), what severe limitation does 'e' indicate?
(A) Excess water or drainage issue
(B) Erosion hazard
(C) Soil root zone limitation due to shallow depth
(D) Climate limitation

77. Semi-arid agricultural districts frequently face which primary type of soil degradation during dry, hot summer months?
(A) Severe gully erosion by rivers
(B) Wind erosion
(C) Waterlogging and extreme salinity
(D) Acid sulphate soil formation

preceding cereal crop from prematurely shedding its grains
(B) Deep roots extract nutrients and moisture from lower soil profiles
(C) Shallow roots cause severe topsoil compaction which deep-rooted legumes require for nodulation
(D) It completely eliminates the requirement for applying any chemical pest control measures in crops

57. The conservation practice of purposefully leaving crop residues anchored in the soil after harvest to protect against wind and water erosion is commonly termed:
(A) Intensive clean tillage
(B) Deep primary ploughing
(C) Stubble mulching
(D) Conventional puddling

58. Compared to conventional heavy tillage, adopting long-term zero tillage (no-till) agriculture generally results in which physical change to the soil microbiome?
(A) A significant and permanent decrease in total soil microbial biomass across all depths
(B) The total and complete elimination of all beneficial mycorrhizal fungal spores in soil
(C) A severe and rapid reduction in active earthworm cast production throughout the field
(D) Higher microbial biomass and fungal-to-bacterial ratio near the surface

59. Which specific actinomycete forms nitrogen-fixing root nodules in non-leguminous plants, such as the Casuarina trees frequently used in coastal and windbreak plantations?
(A) Frankia
(B) Rhizobium
(C) Azospirillum
(D) Cyanobacteria

60. Some soil fungi can solubilize highly fixed soil phosphorus by secreting organic acids. Which of the following is a well-known phosphorus-solubilizing fungus?
(A) Rhizopus stolonifer
(B) Aspergillus awamori
(C) Phytophthora infestans
(D) Puccinia graminis

61. The scientific term "mycorrhiza", which describes the symbiotic relationship essential for soil health, literally translates to:
(A) Sugar-fungus
(B) Fungus-root
(C) Nitrogen-fixing bacteria
(D) Earthworm-cast

62. Applying Neem-coated urea is a common sustainable management practice. Neem acts primarily by inhibiting which soil enzyme, thereby safely reducing nitrogen loss?
(A) Urease
(B) Nitrogenase
(C) Dehydrogenase
(D) Phosphatase

63. The carbon-to-nitrogen (C:N) ratio of the actual cellular mass of living soil microorganisms typically ranges between:
(A) 4:1 to 9:1
(B) 20:1 to 30:1
(C) 50:1 to 80:1
(D) 100:1 to 120:1

64. In a standard soil testing laboratory, organic carbon is most commonly and rapidly estimated using which standard chemical method?
(A) Standard Kjeldahl digestion method
(B) Sodium bicarbonate Olsen method
(C) Dilute acid Bray's extraction method
(D) Walkley-Black method

65. When a hard plough pan has formed in sugarcane fields due to continuous heavy tractor movement, which implement is used for mechanical soil conservation to break it?
(A) Rotavator
(B) Disc harrow
(C) Sub-soiler
(D) Mould-board plough

66. Fast-growing crops cultivated primarily to absorb leftover nutrients in the soil and prevent them from leaching away during heavy off-season rains are termed:
(A) Trap crops
(B) Catch crops
(C) Cash crops
(D) Nurse crops

67. To manage sugarcane ratoons efficiently and conserve crucial soil moisture, farmers are advised to use which post-harvest practice?
(A) Burning all the trash completely in the field

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ANSWERS

1. (C) Sergei Winogradsky
Sergei Winogradsky is recognized as the father of soil microbiology due to his groundbreaking discovery of autotrophic bacteria and chemoautotrophy. He isolated nitrifying bacteria and demonstrated their ability to obtain energy from inorganic nitrogen compounds. His extensive work on free-living nitrogen-fixing organisms significantly advanced the understanding of microbial roles in terrestrial nutrient cycles and soil fertility.

2. (B) Fungi
Fungi constitute the largest portion of microbial biomass in typical agricultural soils, often exceeding that of bacteria and actinomycetes combined. Their extensive network of hyphae allows them to explore large soil volumes, decompose complex organic compounds like lignin, and bridge soil pores. Consequently, fungal biomass contributes substantially to structural soil stability and ecosystem function.

3. (D) Cyanobacteria
Cyanobacteria, commonly referred to as photosynthetic blue green algae, thrive in submerged environmental conditions such as flooded paddy fields. They perform oxygenic photosynthesis and fix atmospheric nitrogen through specialized cells called heterocysts. Many species form symbiotic associations with aquatic Azolla ferns, generating significant natural nitrogen inputs that enhance paddy soil fertility.

4. (A) Actinomycetes
Actinomycetes are filamentous soil bacteria that synthesize organic metabolic products including geosmin. When dry soil receives initial rainfall or undergoes ploughing, geosmin is volatilized and released into the atmosphere, creating the distinct earthy scent known as petrichor. These organisms also play vital roles in breaking down complex organic materials like chitin and cellulose.

5. (B) I and III only
Rhizobium species form specific symbiotic associations with leguminous roots through nodule formation for atmospheric nitrogen fixation. Similarly, Frankia establishes biological nitrogen fixing symbioses in non leguminous woody plants like Casuarina. Conversely, Azotobacter functions as a free living aerobic bacterium that converts atmospheric nitrogen independently without entering into symbiotic root associations with plants.

6. (A) Nitrification
Nitrification is a two step aerobic microbial process converting ammonium into plant available nitrate. Chemoautotrophic bacteria Nitrosomonas first oxidize ammonia into nitrite. Subsequently, Nitrobacter species oxidize nitrite into nitrate. This biological conversion is essential for plant nutrition, although nitrate is highly mobile and prone to leaching losses under heavy rainfall or excessive field irrigation.

7. (D) Pseudomonas
Pseudomonas species act as facultative anaerobic bacteria capable of driving denitrification in flooded or waterlogged soils. Under oxygen limited conditions, these microorganisms utilize soil nitrate as a terminal electron acceptor during respiration. This metabolic pathway sequentially reduces nitrate into gaseous forms including nitrous oxide and dinitrogen, causing substantial nitrogen losses from agricultural soils into the atmosphere.

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8. (D) Assertion (A) is false but Reason (R) is true.
The nitrogenase enzyme responsible for biological nitrogen fixation is irreversibly inactivated by molecular oxygen. Consequently, root nodules produce leghemoglobin, an oxygen binding protein that regulates free oxygen concentration to microaerophilic levels. This protective mechanism permits aerobic respiration in bacterial bacteroids while safeguarding nitrogenase from oxidative destruction, demonstrating that nitrogenase cannot function under high atmospheric oxygen levels.

9. (A) P-3, Q-4, R-1, S-2
Nitrosomonas converts ammonia into nitrite, while Nitrobacter oxidizes nitrite to nitrate during sequential nitrification steps. Azotobacter

78. The deep, severely intersecting gullies formed by extensive water erosion along river banks are locally known as:
(A) Bihad
(B) Khadar lowlands
(C) Old Bhangar soil
(D) Marshy Tarai region

79. Which of the following non-symbiotic nitrogen-fixing bacteria is uniquely known to function effectively under anaerobic (waterlogged) soil conditions?
(A) Aerobic Azotobacter species
(B) Symbiotic Rhizobium species
(C) Clostridium pasteurianum
(D) Autotrophic Nitrobacter species

80. Under the standard Soil Health Card (SHC) scheme, a comprehensive soil test report is designed to provide the status of how many soil parameters to the farmer?
(A) 5 parameters
(B) 8 parameters
(C) 12 parameters
(D) 16 parameters

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(C) P-3, Q-4, R-2, S-1
(D) P-1, Q-2, R-3, S-4

10. During the carbon cycle in soils, what is the dark-colored, complex, and relatively stable organic material formed after extensive microbial decomposition?
(A) Cellulose
(B) Hemicellulose
(C) Lignin
(D) Humus

11. At what critical C:N ratio in crop residues does the net immobilization of soil nitrogen begin to severely affect crop availability during decomposition?
(A) Below 10:1
(B) 15:1 to 20:1
(C) 20:1 to 30:1
(D) Above 30:1

12. Vesicular Arbuscular Mycorrhizae (VAM) are highly beneficial in agriculture primarily because they enhance the host plant's ability to uptake:
(A) Atmospheric Nitrogen
(B) Soil Phosphorus
(C) Soil Carbon
(D) Atmospheric Carbon Dioxide

13. Select the correct decreasing order of the rate of microbial decomposition for various plant components in the soil:
(A) Sugars > Hemicellulose > Cellulose > Lignin
(B) Lignin > Cellulose > Hemicellulose > Sugars
(C) Cellulose > Sugars > Lignin > Hemicellulose
(D) Sugars > Cellulose > Lignin > Hemicellulose

14. Which soil enzyme is most widely considered in soil testing as a reliable biological indicator of overall microbial activity and soil health?
(A) Dehydrogenase
(B) Urease enzyme
(C) Phosphatase enzyme
(D) Protease enzyme

15. Consider the following statements regarding soil survey and mapping:
I. Reconnaissance soil survey is conducted on a small scale for broad regional land-use planning.
II. Detailed soil survey is done at the village or farm level.
III. Aerial photography and satellite imagery cannot be used in base map preparation.
IV. Soil mapping units are determined by examining standard soil profiles in the field.
Which of the above statements are correct?
(A) I, II and III
(B) I, II and IV
(C) II, III and IV
(D) I, III and IV

16. What map scale is typically employed for a 'Detailed Soil Survey' meant for micro-level and farm-level agricultural planning?
(A) 1:250,000 map scale
(B) 1:50,000 map scale
(C) 1:4,000 to 1:8,000
(D) 1:1,000,000 map scale

17. For planting sugarcane, what is the standard recommended depth for collecting a soil sample to accurately assess the nutrient status of its deeper root zone?
(A) 0 to 5 cm
(B) 0 to 15 cm
(C) 0 to 30 cm
(D) 0 to 60 cm

18. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): Soil samples for fertility analysis should never be collected near manure pits, trees, or irrigation channels.
Reason (R): These spots are usually unrepresentative of the entire field's fertility status.
Which of the following is correct?
(A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
(B) Both Assertion (A) and Reason (R) are true but R is not the correct explanation of A.
(C) Assertion (A) is true but Reason (R) is false.
(D) Assertion (A) is false but Reason (R) is true.

19. Match the soil testing methods in List I with the nutrient or parameter they estimate in List II.
List I: Soil Testing Methods
P. Walkley and Black method
Q. Olsen's method
R. Alkaline permanganate method
S. Flame photometer method
List II: Nutrient/Parameter Estimated
1. Available Potassium
2. Available Nitrogen
3. Available Phosphorus
4. Organic Carbon
(A) P-4, Q-3, R-2, S-1

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performs free living biological nitrogen fixation independently in aerated soils without forming plant nodules. Rhizobium establishes a host specific symbiotic association within legume roots to convert atmospheric dinitrogen into plant available ammonium, completing crucial biochemical pathways within terrestrial nitrogen transformations.

10. (D) Humus
Humus is a dark, amorphous, and highly stable organic substance formed through humification during advanced microbial decomposition of plant and animal residues. Resistant to rapid enzymatic degradation, humus possesses high cation exchange capacity and water retention properties. Its presence improves soil aggregation, buffers soil pH, stores essential organic carbon, and significantly enhances long term soil fertility.

11. (D) Above 30:1
When crop residues with a carbon to nitrogen ratio above 30:1 are incorporated into soil, decomposer microorganisms experience nitrogen deficits. To break down carbon rich material like straw, microbes absorb inorganic nitrogen from the surrounding soil solution. This process causes temporary net nitrogen immobilization, competing directly with growing crops and causing transient nitrogen deficiencies unless additional fertilizer is applied.

12. (B) Soil Phosphorus
Vesicular Arbuscular Mycorrhizae form symbiotic associations with plant roots, extending fine fungal hyphae far beyond the root depletion zone. Because soil phosphorus is highly immobile, these fungal networks absorb soil phosphate ions from soil pores that root hairs cannot access. In exchange, the host plant provides photosynthetically derived carbohydrates, significantly increasing phosphorus acquisition efficiency in nutrient deficient soils.

13. (A) Sugars > Hemicellulose > Cellulose > Lignin
Microbial decomposition rates of plant residue components depend directly on chemical complexity and structural stability. Water-soluble organic compounds like simple sugars degrade most rapidly, followed by hemicellulose and complex cellulose polymers. Lignin, a highly aromatic and recalcitrant structural molecule, resists enzymatic breakdown and decomposes slowest, eventually providing structural precursors required for persistent soil humus synthesis during humification.

14. (A) Dehydrogenase
Dehydrogenase enzyme activity serves as a primary indicator of overall biological activity in soil because it exists exclusively within viable living microbial cells. Dehydrogenases catalyze essential oxidative intracellular reactions during respiratory electron transport systems. Unlike accumulated extracellular enzymes, dehydrogenase activity drops rapidly upon cell death, reflecting real-time metabolic status, soil microbiological health, and active biological functioning in cropland soils.

15. (B) I, II and IV
Reconnaissance soil surveys utilize small mapping scales for broad land planning across extensive areas, whereas detailed soil surveys operate on large scales suitable for farm-level decision making. Examining representative soil profile pits establishes boundary mapping units. Remote sensing techniques, including aerial photography and satellite imagery, are routinely integrated as fundamental base maps to enhance soil boundaries identification and spatial mapping accuracy.

16. (C) 1:4,000 to 1:8,000
Detailed soil surveys demand high-resolution spatial mapping to capture micro-level soil variations for individual agricultural fields, farm layout planning, and irrigation management. A large scale ranging from 1:4,000 to 1:8,000 allows precise demarcation of soil boundaries, slope changes, and land capability classes, providing essential quantitative data required for targeted agronomic interventions and localized land-use decisions.

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17. (C) 0 to 30 cm
Sugarcane is a long-duration, deep-rooted crop requiring comprehensive soil nutrient evaluation across its primary active root zone. While standard shallow crops are sampled to 15 cm depth, sugarcane fields require sampling down to 30 cm depth. Sampling this deeper plow layer ensures accurate assessment of reserve phosphorus, potassium, and subsoil moisture dynamics supporting healthy stool establishment.

disturbances such as drought, tillage, or chemical inputs.

36. (A) Mulching
Mulching is a soil conservation technique where organic residues, crop straw, or synthetic polyethylene sheets cover bare soil surfaces between crop rows. The physical layer insulates the soil surface against direct solar radiation, suppressing evaporation losses and moderating soil temperatures. Organic mulches also improve water infiltration, prevent surface crusting, reduce weed growth, and gradually decompose into beneficial soil humus.

37. (C) Bentonite clay
Bentonite clay is a sodium-rich smectite clay widely utilized as an impermeable lining material in farm pond construction. When hydrated, bentonite expands dramatically, filling inter-particle pore spaces within coarse subsoils. This swelling creates an effective hydraulic seal that minimizes deep percolation and lateral seepage losses, ensuring harvested surface runoff water is retained for supplemental crop irrigation during dry spells.

38. (A) Splash erosion → Sheet erosion → Rill erosion → Gully erosion
Water erosion progresses through four distinct sequential stages. Raindrop impact initiates splash erosion by detaching soil particles. Concentrated surface runoff causes uniform thin topsoil removal termed sheet erosion. As runoff velocity increases, flow concentrates into tiny well-defined channels forming rill erosion. Continued channel enlargement and scour deepen these rills into extensive, impassable gullies, representing advanced soil degradation across land landscapes.

39. (A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
Sheet erosion involves the uniform removal of thin layer of fertile topsoil by shallow surface runoff across sloping lands. Because it lacks dramatic channel formation or visible scars, farmers rarely detect this gradual topsoil loss in its early phases. However, it strips organic matter and available nutrients, resulting in insidious fertility decline and sudden productivity collapse, earning its descriptive phrase.

40. (B) Gypsum
Gypsum, or calcium sulphate dihydrate, is the primary chemical amendment used to reclaim sodic (Usar) soils. Sodic soils suffer from high exchangeable sodium percentages that break down structure and severely impair permeability. Soluble calcium ions supplied by gypsum displace exchangeable sodium from soil clay complexes. The displaced sodium forms soluble sodium sulphate, which is subsequently leached down beyond root zones with excess water.

41. (B) I, II and IV
Land capability classification categorizes lands based on agricultural constraints, where Classes I through IV represent arable lands suitable for cultivation. Watersheds serve as natural hydrological operational units for integrated land use planning. Conversely, Class VIII lands possess extreme physical limitations like bare rock or steep cliffs, restricting their utility strictly to wildlife conservation, recreation, or hydrological watershed protection rather than intensive farming.

42. (D) To promote balanced fertilizer use and alternative nutrients
The PM-PRANAM scheme aims to restore soil health and lower environmental degradation by reducing excessive reliance on synthetic chemical fertilizers. It incentivizes Indian states to adopt balanced fertilizer management by integrating organic manures, biofertilizers, and nano-fertilizers into conventional cropping systems. Reducing chemical subsidy expenditure encourages sustainable nutrient practices, prevents subsoil contamination, and preserves long-term agricultural soil productivity.

43. (A) Physical mixing and aeration of soil profiles
Bioturbation describes the active biological reworking, displacement, and physical mixing of soil particles and organic matter by soil organisms, predominantly earthworms. As earthworms burrow through soil strata, they create continuous macropores that improve aeration, water infiltration, and root penetration. Their ingestion and deposition of organic material as mineral-rich casts enhances soil aggregate stability and accelerates nutrient cycling.

44. (A) P-3, Q-4, R-2, S-1
PKVY promotes cluster-based organic farming practices. PMKSY enhances farm-level water

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27. (B) I, II and IV
Contour bunds suit permeable soils in low rainfall areas by retaining runoff to enhance infiltration, whereas graded bunds safely channel excess runoff in high rainfall regions exceeding 600 mm annually. Zingg terracing splits slopes into contributing runoff zones and level receiving basins. Bench terracing, however, is implemented exclusively on steep hill slopes between 16 and 33 percent gradient.

28. (C) Assertion (A) is true but Reason (R) is false.
Bench terracing is an intensive engineering conservation practice that transforms steep, sloping hillside topography into a vertical series of continuous, horizontal, step-like level platforms. This structural modification intercepts surface runoff and enables safe crop cultivation. However, bench terracing is designed specifically for steep hill slopes ranging between 16 and 33 percent slope, making it unsuitable for gentle 1 to 2 percent slopes.

29. (B) Chrysopogon zizanioides
Chrysopogon zizanioides, commonly known as vetiver grass, is widely utilized in bio-engineering for soil and water conservation. Its dense, finely structured, deep root system penetrates up to three meters into the subsoil, binding earth tightly together. Planted along contours or gully floors, vetiver forms dense vegetative hedges that slow surface runoff velocity, trap eroded sediment, and stabilize earthen bunds.

30. (A) Triangular shape
Shelterbelts are multi-row barrier plantings of trees and shrubs designed to reduce wind speed across farm fields. Designing a shelterbelt cross-section in a triangular geometric profile—with tall central tree species flanked by medium trees and short shrubs on outer edges—forces oncoming erosive winds upwards smoothly. This wedge structure minimizes wind turbulence and maximizes downwind sheltered zone length.

31. (A) P-2, Q-3, R-4, S-1
Agronomic conservation measures suit gentle slopes under 2 percent. Contour bunding retains soil moisture on slopes up to 6 percent in semi-arid, low rainfall regions. Graded bunding safely drains surplus surface runoff on slopes between 2 and 10 percent in high rainfall zones. Bench terracing modifies steep hill slopes between 16 and 33 percent into level farming steps for soil protection.

32. (D) Contour strip cropping
Contour strip cropping combines contour farming with crop rotation by planting erosion-permitting crops like maize or sorghum in alternating strips with erosion-resisting canopy crops like legumes across field slopes. The dense foliage and root systems of erosion-resisting strips absorb raindrop impacts, check surface water velocity, filter suspended sediment, and promote infiltration, dramatically reducing overall field erosion rates.

33. (C) To cover the soil surface and prevent wind and water erosion
Cover crops are close-growing vegetation established primarily to protect unplanted soil surfaces during off-seasons or fallow periods. By intercepting falling raindrops with their dense foliage, cover crops prevent splash erosion and soil crust formation. Their root networks anchor soil particles against wind and water detachment, while suppressing weed growth, adding organic matter, and improving overall soil hydraulic conductivity.

34. (B) I and III only
Alternating shallow-rooted cereals with deep-rooted crops optimizes nutrient uptake across distinct soil depth horizons while preventing localized soil compaction. Rotating non-host plants disrupts host-specific soil pest and pathogen lifecycles, suppressing disease build-up naturally. Legumes enrich soil fertility by capturing atmospheric nitrogen via biological fixation rather than depleting soil nitrogen reserves, making statement II factually incorrect within sustainable cropping systems.

35. (D) Enhanced ecological resilience and nutrient cycling
A highly diverse soil microbiome ensures functional redundancy and complex biochemical networks within terrestrial ecosystems. Diverse microbial communities drive efficient organic matter breakdown, active carbon mineralization, and balanced nutrient transformations. Furthermore, taxonomic diversity suppresses soil pathogens through biological competition and endows the soil system with ecological resilience, enabling rapid recovery from environmental

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managing salt-affected soils. The institute develops standardized technologies for reclaiming saline, sodic, and waterlogged lands. Innovations include gypsum application packages, subsurface drainage designs, salt-tolerant crop varieties, and agroforestry systems tailored to restore degraded agricultural lands to high productivity.

71. (D) Permissible soil loss
Permissible soil loss, or soil loss tolerance (T-value), represents the maximum threshold rate of annual soil erosion that permits long-term crop economic productivity to be sustained indefinitely. It balances soil loss with natural rates of topsoil formation. Maintaining erosion rates below this limit preserves topsoil depth, organic matter reserves, plant nutrient capacity, and structural soil integrity.

72. (B) It decreases due to increased pore space
Primary deep tillage mechanically loosens consolidated soil matrices, creating large inter-aggregate voids and increasing total pore space. Because bulk density represents total dry soil mass divided by total volume (including solids and pore spaces), increasing soil volume through tillage immediately decreases overall soil bulk density. This temporal reduction enhances soil aeration, root growth, and surface water infiltration rates.

73. (C) Field capacity
Soil moisture at field capacity provides the optimal balance between soil water availability and oxygen aeration within macropores. Aerobic decomposer microorganisms require abundant oxygen for metabolic respiration and liquid water films for nutrient diffusion and cellular motility. At field capacity, microbial activity, organic matter decomposition rates, and nutrient mineralization reach peak biological efficiency in agricultural soils.

74. (D) Cation Exchange Capacity
Humus possesses a highly developed colloidal structure featuring immense surface area and dense net negative surface charges originating from ionized carboxyl and phenolic functional groups. These negative sites reversibly adsorb essential nutrient cations such as calcium, magnesium, potassium, and ammonium. Consequently, high soil humus content directly confers elevated cation exchange capacity, preventing nutrient leaching losses.

75. (A) Residual chemicals will contaminate the sample and alter test results
Using empty chemical fertilizer bags for soil sample collection or storage introduces severe chemical contamination. Residual fertilizer dust adhering to bag linings dissolves into soil moisture, falsely inflating lab analytical readings for nitrogen, phosphorus, potassium, or micronutrients. Soil samples must be collected and stored strictly in clean, unused polythene bags to ensure accurate soil fertility assessment.

76. (B) Erosion hazard
In the Land Capability Classification system, lowercase letters appended to land class numerals designate specific soil limitations. Subclass 'e' specifically denotes a primary risk or hazard of soil erosion caused by wind or water. Land assigned subclass 'e' requires continuous soil conservation practices, such as contour farming or cover cropping, to prevent topsoil loss and maintain productive agricultural utility.

77. (B) Wind erosion
During dry, hot summer months in semi-arid agricultural regions, high temperatures desiccate surface soils, eliminating protective moisture films between particles. Lack of vegetative cover combined with high-velocity wind currents causes widespread wind erosion. Strong winds detach and transport loose topsoil particles through saltation and suspension, causing severe nutrient depletion, crop seedling damage, and land desertification.

78. (A) Bihad
Extensive water erosion along major river basins, notably the Chambal and Yamuna rivers, creates intricate networks of deep, severely intersecting gullies and ravines. Locally designated as "Bihad", these highly degraded badlands feature steep side slopes, completely stripped topsoil, and severe structural collapse. Rehabilitation requires intensive bio-engineering, gully control structures, check dams, and protective afforestation programs.

79. (C) Clostridium pasteurianum
Clostridium pasteurianum is a free-living, obligate anaerobic bacterium capable of fixing atmospheric dinitrogen gas without forming symbiotic plant host structures. Discovered by Sergei Winogradsky, it functions efficiently in oxygen-depleted, waterlogged, or flooded soil

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application efficiency through micro-irrigation systems under "more crop per drop". The Soil Health Card scheme assesses twelve essential soil parameters to provide customized fertilizer recommendations. PM-PRANAM reduces synthetic fertilizer subsidies by encouraging alternative biological and organic plant nutrients, supporting long-term soil resource conservation nationwide.

45. (B) Heavy metals
Irrigating crops with untreated industrial wastewater loads agricultural soils with toxic heavy metals such as cadmium, lead, chromium, and nickel. Unlike organic compounds, heavy metals non-biodegradably persist in the soil matrix, binding to clay and humus particles. Over time, high concentrations inhibit beneficial soil microbial enzymes, reduce fertility, induce plant phytotoxicity, and enter human food chains through bioaccumulation.

46. (A) Phytoremediation
Phytoremediation is an eco-friendly green technology utilizing living plant species to clean up soils contaminated with heavy metals or organic pollutants. Hyperaccumulating plants absorb toxic elements through root systems, translocating and concentrating them in harvestable above-ground biomass. Sub-mechanisms include phytoextraction, rhizofiltration, and phytostabilization, offering a cost-effective alternative to physical or chemical soil decontamination engineering methods.

47. (C) II and III only
Accumulated heavy metals like cadmium bind directly to active sites on soil enzymes, drastically inhibiting biological catalase, urease, and phosphatase functions. Similarly, acidic industrial effluents lower soil pH, disrupting beneficial microbial communities such as nitrifying bacteria and nitrogen fixers. Conversely, uncalibrated pesticide usage generally depresses overall fungal diversity rather than stimulating indiscriminate fungal growth in agricultural soils.

48. (D) Integrated Nutrient Management
Integrated Nutrient Management is a holistic soil fertility strategy combining mineral chemical fertilizers, bulky organic manures, green manures, and microbial biofertilizers in balanced combinations. This approach optimizes plant nutrient availability, minimizes chemical fertilizer leaching losses, improves soil physical structure, and enhances biological health. By maintaining soil organic matter levels, it secures high crop yields while preserving long-term environmental quality.

49. (C) Gluconacetobacter diazotrophicus
Gluconacetobacter diazotrophicus is an acid-tolerant, sugar-loving endophytic bacterium that colonizes internal vascular tissues, roots, stems, and leaves of sugarcane plants. It converts atmospheric nitrogen into ammonia directly inside plant tissues without forming external root nodules. This intimate endophytic relationship provides substantial nitrogen inputs to sugarcane crops, reducing synthetic nitrogenous fertilizer requirements while promoting plant growth through hormone secretion.

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50. (B) Ammonia (NH3)
Symbiotic nitrogen-fixing bacteria like Rhizobium utilize adenosine triphosphate generated from host plant carbohydrates to fuel the nitrogenase enzyme complex. Nitrogenase reduces inert atmospheric dinitrogen gas into ammonia. Within root nodule cells, ammonia rapidly protonates into ammonium, which is assimilated into amino acids and organic compounds, supplying the host plant with readily usable nitrogen for cellular growth.

51. (D) Glomalin
Glomalin is a hydrophobic glycoprotein secreted abundantly by arbuscular mycorrhizal fungi into soil pores. Functioning as a natural biological binding agent or "soil glue", glomalin glues fine mineral particles and organic debris together into water-stable soil aggregates. Highly resistant to rapid microbial degradation, glomalin improves soil structural stability, enhances water infiltration, protects soil carbon, and reduces erosion.

52. (A) Soil Erodibility Factor
In the Universal Soil Loss Equation, factor K quantifies intrinsic soil erodibility, reflecting a specific soil type's vulnerability to particle detachment and transport by raindrop impact and surface runoff. Calculated under standard unit plot conditions, K depends on soil texture, organic matter content, structural stability, and profile permeability, directly determining expected annual soil loss under rainfall.

CHAPTER 17

Irrigation, Drainage and Water Harvesting Management

1. Which of the following is the largest source of irrigation in Uttar Pradesh in terms of total irrigated area?
(A) Canal network
(B) Tube wells
(C) Tanks and ponds
(D) Open wells

2. Which surface irrigation method is most suitable for close-growing crops like wheat on relatively flat lands?
(A) Furrow method
(B) Ring basin method
(C) Corrugation method
(D) Check basin method

3. Consider the following statements regarding surface irrigation methods:
I. Furrow irrigation is highly suitable for row crops like sugarcane and potato.
II. Check basin irrigation provides the highest water application efficiency among all surface methods.
III. Border strip irrigation is well-suited for medium to heavy textured soils with gentle slopes.
Which of the above statements is/are correct?
(A) I and II only
(B) II and III only
(C) I and III only
(D) I, II and III

4. In the context of micro-irrigation, what is the primary function of a venturi in a drip irrigation system?
(A) To filter physical impurities from the water
(B) To measure the pressure of the flowing water
(C) To inject liquid fertilisers into the irrigation line
(D) To regulate the discharge rate at the emitter

5. Which of the following is a major limitation of the sprinkler irrigation method?
(A) High wind velocity reduces water distribution uniformity
(B) It cannot be applied on highly undulating land topography
(C) It requires significantly higher labor than surface flooding
(D) It is suitable only for deep-rooted crops like sugarcane

6. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): Adopting the skip-furrow method of irrigation in sugarcane cultivation saves a significant amount of water.
Reason (R): In the skip-furrow method, irrigation is applied to alternate furrows, thereby reducing the total wetted area.
(A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).
(B) Both Assertion (A) and Reason (R) are true but Reason (R) is not the correct explanation of Assertion (A).
(C) Assertion (A) is true but Reason (R) is false.
(D) Assertion (A) is false but Reason (R) is true.

7. Under the drip irrigation method, water is supplied directly to the root zone of the plants. What is the typical water saving achieved in drip irrigation compared to traditional flood irrigation?
(A) 10 to 15 percent
(B) 20 to 30 percent
(C) 40 to 60 percent
(D) 80 to 95 percent

8. For sugarcane cultivation in Uttar Pradesh, which irrigation method is considered most practical and water-efficient for commercial field adoption?
(A) Surface flooding
(B) Check basin method
(C) Furrow method
(D) Sub-surface irrigation

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partnership, fungal hyphae absorb water and immobile soil nutrients for the plant, receiving plant-synthesized carbohydrates and carbon compounds in return.

62. (A) Urease
Neem-coated urea incorporates natural triterpenes and neem oil extracts that act as potent biological urease inhibitors and nitrification inhibitors. Extracellular urease enzymes produced by soil bacteria rapidly hydrolyze applied urea into volatile ammonium carbonate. By inhibiting urease activity, neem coatings slow down urea hydrolysis rates, curbing ammonia volatilization and subsequent nitrate leaching while improving nitrogen fertilizer use efficiency.

63. (A) 4:1 to 9:1
Living soil microorganisms maintain a narrow cellular carbon to nitrogen ratio, typically ranging between 4:1 and 9:1, due to their high protoplasmic protein content. Bacteria generally exhibit tighter ratios around 5:1, whereas fungal cellular tissue averages closer to 8:1 or 10:1. This internal stoichiometric balance dictates microbial nitrogen demands during crop residue decomposition and influences mineralization-immobilization turnover rates.

64. (D) Walkley-Black method
The Walkley-Black wet oxidation method is the standard laboratory procedure used for rapid soil organic carbon determination. Soil samples react with potassium dichromate and concentrated sulfuric acid, utilizing heat of dilution to oxidize active organic carbon fractions. Unreduced dichromate is back-titrated against ferrous ammonium sulfate using diphenylamine indicator, providing an accurate estimation of soil organic matter content.

65. (C) Sub-soiler
Repeated machinery traffic and shallow tillage operations often create dense, impermeable hardpan layers below the normal plough layer in sugarcane soils. A subsoiler is a heavy-duty chisel-type primary tillage implement designed to operate at depths from 40 to 60 cm. It shatters compacted subsoil pans without turning soil layers, restoring deep vertical drainage, root penetration, and soil aeration.

66. (B) Catch crops
Catch crops are fast-growing, short-duration crops planted between main cropping seasons to scavenge residual soil nutrients, particularly mobile nitrates, remaining after primary crop harvest. By rapidly establishing dense root networks, catch crops absorb residual nitrogen and prevent deep leaching losses during heavy seasonal rainfall. Upon incorporation or termination, stored nutrients are recycled back into the topsoil for subsequent crops.

67. (D) Trash mulching between cane rows
Trash mulching involves retaining and spreading dry sugarcane leaves and crop residues evenly between ratoon crop rows after harvest. This protective organic layer minimizes evaporative soil moisture loss, suppresses weed germination, moderates soil surface temperatures, and prevents raindrop-induced soil erosion. Over time, decomposing cane trash contributes organic matter to topsoil, enhancing long-term ratoon productivity and microbial activity.

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68. (A) Pressmud
Pressmud, also called filter cake, is a valuable organic by-product obtained during sugarcane juice clarification in sugar factories. Containing high quantities of organic matter, calcium, sulfur, phosphorus, and essential micronutrients, pressmud serves as an effective soil conditioner. Applied to agricultural soils, it improves physical structure, buffers soil pH, corrects micronutrient deficiencies, and reclaims acidic or sodic soil conditions.

69. (C) Pradhan Mantri Krishi Sinchayee Yojana
Pradhan Mantri Krishi Sinchayee Yojana was launched with the core motto "Har Khet Ko Pani" to expand assured irrigation coverage across agricultural lands. The scheme integrates water source creation, watershed development, rainwater harvesting, and efficient distribution networks. By combining surface runoff conservation with precision micro-irrigation technologies ("More Crop Per Drop"), it optimizes agricultural water use efficiency and mitigates drought vulnerability.

70. (A) Central Soil Salinity Research Institute, Karnal
The ICAR - Central Soil Salinity Research Institute, located in Karnal, Haryana, is India's premier research organization dedicated to

18. (A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
Soil sampling aims to obtain a representative composite sample reflecting true field fertility. Areas adjacent to manure pits, shade trees, compost heaps, fence lines, and irrigation channels exhibit localized nutrient accumulation, altered organic matter, or disturbed moisture regimes. Sampling these unrepresentative spots introduces severe bias, corrupting laboratory analytical results and leading to inaccurate fertilizer recommendations for the entire field area.

19. (A) P-4, Q-3, R-2, S-1
Walkley and Black wet oxidation quantifies soil organic carbon. Olsen's sodium bicarbonate extraction estimates available phosphorus in neutral to alkaline soils. The alkaline permanganate distillation technique liberates mineralizable soil nitrogen for laboratory estimation. Flame photometry measures extractable potassium ions displaced by ammonium acetate extraction, providing precise analytical quantification of essential primary macronutrient availability in agricultural soil samples.

20. (B) 2.5 hectares
The Soil Health Card scheme standardizes systematic grid sampling to evaluate soil nutrient profiles efficiently across farming regions. In irrigated agricultural lands, higher management intensity and spatial variability mandate collecting composite soil samples within a 2.5-hectare grid. Conversely, rainfed farming areas utilize wider 10-hectare grids, balancing analytical sampling precision with logistical feasibility across diverse agricultural landscapes.

21. (B) I and III only
Soil sampling requires avoiding fertilizer bands and crop rows to prevent artificial nutrient contamination. Cutting V-shaped pits allows collecting uniform soil slices from surface to plough depth. Samples must be shade dried at room temperature, as exposing soil to direct intense sunlight or high heat volatilizes nitrogen compounds and alters delicate microbial chemical balances prior to laboratory fertility analysis.

22. (A) Green
Standardized land capability classification maps employ distinct color codes to designate land suitability for agriculture and non-arable uses. Class I land represents highly fertile, nearly level, deep, and well-drained soils with minimal erosion hazards, making it ideal for intensive cultivation. On standard soil survey maps, Class I land is universally designated using a prominent green color representation.

23. (D) Splash erosion
Splash erosion represents the introductory phase of water erosion on bare, unprotected soils. High-velocity falling raindrops impact the soil surface, transferring kinetic energy that breaks down soil aggregates and detaches fine soil particles. These detached particles are splashed upwards and outwards into the air, clogging soil pores, reducing infiltration capacity, and initiating subsequent surface runoff and sheet wash processes.

24. (A) 2, 4, 1, 3
Proper soil sample preparation follows a strict sequential protocol to preserve analytical integrity. Freshly collected composite field samples are first air-dried in shade to eliminate moisture. Next, quartering systematically reduces bulk sample mass to a manageable 500-gram laboratory sample. This reduced portion is gently ground using a wooden mortar and pestle, then sieved through a standard 2 mm mesh.

25. (C) Saltation
Saltation is the dominant physical transport mechanism during wind erosion, responsible for 50 to 75 percent of total soil movement. Intermediate soil particles ranging from 0.1 to 0.5 mm in diameter are lifted short distances into the air by wind turbulence, moving in short bouncing leaps. Upon striking the soil surface, saltating grains dislodge finer particles into suspension.

26. (A) 2 percent
Agronomic conservation practices, including contour farming, strip cropping, cover cropping, and mulching, control soil erosion by maintaining surface cover and reducing runoff velocity. These bio-cultural measures are most effective and financially viable on gently sloping agricultural lands where slope gradient remains below 2 percent. On steeper slopes, agronomic measures must be reinforced with mechanical engineering structures like bunds or terraces.

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environments where aerobic nitrogen fixers cannot survive. It utilizes fermentative metabolic pathways to reduce molecular nitrogen into ammonium, contributing to soil fertility in saturated soils.

80. (C) 12 parameters
The Soil Health Card scheme provides farmers with a standardized report covering twelve key soil parameters. These include physical parameters pH, electrical conductivity, and organic carbon; primary macronutrients nitrogen, phosphorus, and potassium; secondary nutrient sulphur; and micronutrients zinc, iron, copper, manganese, and boron. This comprehensive matrix guides balanced crop fertilization and promotes efficient soil health management across farming holdings.

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53. (C) Check dams
Check dams are small, low-profile barrier structures constructed across drainage channels, gullies, or small streams using locally available materials like loose rock, brushwood, sandbags, or timber. By flattening the effective channel slope, check dams reduce surface water flow velocity, prevent further channel bed scouring, induce sediment deposition behind the barrier, and promote groundwater recharge in watershed areas.

54. (C) Perpendicular to the wind direction
Windbreaks and shelterbelts function as physical barriers that intercept horizontal airflow to lower wind velocity across agricultural fields. Planting tree rows perpendicular to the direction of prevailing erosive winds establishes a physical barrier that deflects wind currents upward. This alignment maximizes downwind sheltered zone area, minimizes soil particle detachment, and protects fragile growing crops from wind-induced abrasion.

55. (B) Across the slope along elevation contour lines
Contour farming involves performing all field operations—including primary tillage, land preparation, planting, and cultivation—across field slopes along lines of equal elevation. Ridges, furrows, and crop rows created along contours act as miniature earthen barriers that trap falling rainwater, break surface runoff velocity, promote water infiltration into topsoil, and drastically reduce soil loss compared to up-and-down slope farming.

56. (B) Deep roots extract nutrients and moisture from lower soil profiles
Alternating shallow-rooted cereals with deep-rooted leguminous crops optimizes subterranean soil resource utilization. Deep taproots of legumes penetrate dense subsoil horizons, absorbing water and leached nutrients that shallow cereal roots cannot access. Additionally, decaying deep roots create continuous biopores that enhance subsoil aeration, while root-associated Rhizobium bacteria fix atmospheric nitrogen, replenishing fertility in depleted upper soil horizons.

57. (C) Stubble mulching
Stubble mulching is a key conservation tillage practice where crop residues and stubble are purposefully left standing or partially incorporated on field surfaces after harvest. The standing stubble breaks wind velocity near ground level, preventing saltation, while anchored surface residues absorb falling raindrop impact energy, prevent soil crusting, reduce surface water runoff, and preserve critical subsoil moisture reserves.

58. (D) Higher microbial biomass and fungal-to-bacterial ratio near the surface
Eliminating mechanical tillage avoids disrupting fragile fungal hyphal networks and preserves protective crop residue covers on surface soils. Consequently, long-term zero tillage shifts microbial community structures toward higher fungal dominance, significantly increasing fungal-to-bacterial biomass ratios near topsoil horizons. Undisturbed surface layers also accumulate organic carbon, fostering elevated total microbial biomass, earthworm activity, and overall soil biological health.

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59. (A) Frankia
Frankia is a genus of filamentous, nitrogen-fixing actinomycetes that forms actinorhizal root nodule symbioses with non-leguminous woody perennial plants. Hosts include Casuarina, Alnus, and Myrica species. Inside specialized multilocular sporangia and vesicles, Frankia fixes atmospheric dinitrogen gas under protected microaerophilic conditions, enabling host trees to colonize nitrogen-deficient sandy soils, degraded coastal sand dunes, and windbreak shelterbelts successfully.

60. (B) Aspergillus awamori
Aspergillus awamori is a potent phosphorus-solubilizing soil fungus widely used as a biofertilizer inoculant. Soil phosphorus frequently forms insoluble complexes with iron, aluminum, or calcium. Aspergillus awamori secretes low-molecular-weight organic acids—such as citric, gluconic, and oxalic acids—that chelate metal cations and lower localized rhizosphere pH, releasing bound phosphate into plant-available orthophosphate forms for root uptake.

61. (B) Fungus-root
The term "mycorrhiza" originates from classical Greek roots, combining "mykes" meaning fungus and "rhiza" meaning root. It literally translates to "fungus-root", describing the mutualistic symbiotic association formed between specialized soil fungi and higher plant roots. In this

9. Irrigation through ponds and tanks is a traditional practice and is most prevalent in which agro-climatic region of Uttar Pradesh?
(A) Western Plain Zone
(B) Tarai Region
(C) Central Plain Zone
(D) Bundelkhand Region

10. Surge irrigation is a modified form of surface irrigation. Which of the following best defines surge irrigation?
(A) Intermittent on-off application of water in cycles
(B) Continuous application of water at a high flow rate
(C) Continuous pumping of irrigation water from deep aquifers
(D) Flooding fields until a specific water depth is reached

11. What is the approximate water requirement (consumptive use) for a standard 12-month sugarcane crop grown in sub-tropical regions like North India?
(A) 500 to 800 mm
(B) 900 to 1200 mm
(C) 1500 to 2500 mm
(D) 3000 to 3500 mm

12. Arrange the following components of a standard drip irrigation system in the correct order from the primary water source to the crop root zone:
1. Main line
2. Emitter
3. Media filter
4. Sub-main
5. Lateral

(A) 3-1-4-5-2
(B) 1-3-4-2-5
(C) 3-4-1-5-2
(D) 1-4-3-5-2

13. Which of the following is the most critical stage for irrigation in sugarcane crop to prevent severe yield loss?
(A) Formative phase
(B) Germination phase
(C) Grand growth phase
(D) Ripening phase

14. Fertigation is the application of fertilisers along with irrigation water. This technique is most efficient and commonly adopted in which method of irrigation?
(A) Check basin irrigation
(B) Furrow irrigation
(C) Drip irrigation
(D) Sprinkler irrigation

15. Crop Water Use Efficiency (WUE) is mathematically expressed by which of the following formulas?
(A) Evapotranspiration divided by Crop Yield
(B) Crop Yield divided by Total Water Requirement
(C) Total Water Applied divided by Crop Yield
(D) Crop Yield divided by Evapotranspiration

16. Match the irrigation methods in List I with their corresponding suitable condition/crop in List II.
List I: (Irrigation Method)
P. Drip irrigation
Q. Sprinkler irrigation
R. Furrow irrigation
S. Check basin irrigation
List II: (Suitable Condition/Crop)
1. Undulating topography and sandy soils
2. Row crops like potato and sugarcane
3. Wide-spaced orchard crops and vegetables in water-scarce areas
4. Close-growing crops like wheat on flat terrain

(A) P-3, Q-1, R-2, S-4
(B) P-1, Q-3, R-4, S-2
(C) P-3, Q-1, R-4, S-2
(D) P-1, Q-2, R-3, S-4

17. Which chemical is most commonly injected into a drip irrigation system to dissolve chemical precipitates and clean the emitters to prevent clogging?
(A) Sodium chloride
(B) Hydrochloric acid
(C) Calcium carbonate
(D) Potassium sulphate

18. Consider the following statements regarding the benefits of adopting micro-irrigation schemes for farmers:
I. Reduction in weed growth compared to surface flooding.
II. Increase in fertiliser use efficiency through targeted application.
III. Suitability for soils with very low infiltration rates.
IV. Significant reduction in operational energy costs due to high pressure requirements.
Which of the above statements is/are correct?

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61. In many districts of western Uttar Pradesh, the groundwater level has declined to critical depths. What is the most prominent cause of this alarming decline?
(A) Over-exploitation of groundwater for agriculture
(B) Significant decrease in the overall intensity of surface canal irrigation
(C) Widespread construction of artificial percolation tanks across watersheds
(D) Deep sub-surface tile drainage systems installed in agricultural fields

62. Which artificial groundwater recharge method is highly suitable for areas where a shallow impermeable clay layer overlies a deeper, unconfined sandy aquifer?
(A) Contour bunding on sloping land
(B) Broad Bed and Furrow field system
(C) Recharge shaft
(D) Check basin flooding method

63. The Government of India launched the Pradhan Mantri Krishi Sinchayee Yojana (PMKSY) with the vision of extending the coverage of irrigation and improving water use efficiency. In which year was PMKSY launched?
(A) 2011
(B) 2013
(C) 2015
(D) 2019

64. The component "Har Khet Ko Pani" under PMKSY specifically focuses on:
(A) Promoting high-efficiency drip and sprinkler systems to all farm categories
(B) Providing key chemical fertilisers and micronutrients at subsidised rates
(C) Creating new water sources and restoring traditional water bodies
(D) Comprehensive insuring of agricultural crops against severe drought events

65. The Command Area Development Programme (CADP) was launched by the Government of India in 1974-75. What was its primary objective?
(A) To construct multi-purpose mega dams and storage reservoirs on major rivers
(B) To bridge the gap between created and utilized irrigation potential
(C) To distribute free solar-powered water pumps to small and marginal farmers
(D) To eradicate major sugarcane insect pests through systematic aerial spraying

66. Under the Command Area Development Programme, water management at the lowest administrative level (the field channel network below the outlet) is ideally entrusted to:
(A) The State Irrigation Department executive engineers
(B) The Central Water Commission regional Directorate
(C) The District Magistrate's rural development office
(D) Farmer-led Water User Associations

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67. Under the PMKSY 'Per Drop More Crop' scheme, what is the standard funding pattern shared between the Central Government and the State Government of Uttar Pradesh for providing micro-irrigation subsidies?
(A) 50:50
(B) 60:40
(C) 90:10
(D) 100:0 (Fully Centrally Sponsored)

68. Match the scheme/component in List I with its core objective in List II.
List I: (Scheme/Component)
P. AIBP (Accelerated Irrigation Benefit Programme)
Q. Har Khet Ko Pani
R. Per Drop More Crop
S. Watershed Development
List II: (Core Objective)
1. Ridge area treatment, soil and moisture conservation
2. Completion of ongoing major and medium irrigation projects
3. Creation of new minor irrigation sources and repair of water bodies
4. Promotion of micro-irrigation and precision water application
(A) P-2, Q-3, R-4, S-1
(B) P-1, Q-2, R-3, S-4
(C) P-3, Q-1, R-2, S-4
(D) P-2, Q-4, R-3, S-1

69. Consider the following statements regarding the causes and management of groundwater level decline:
I. Shifting cropping patterns towards water-intensive crops like paddy and sugarcane accelerates groundwater depletion.
II. Concrete lining of unlined canals permanently increases natural groundwater recharge.
III. Constructing recharge trenches along surface drains helps mitigate groundwater decline.

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(D) Supplemental field flooding

30. Which soil moisture tension is generally considered the 'Field Capacity' for medium-textured soils?
(A) -0.1 to -0.33 bar (or atm)
(B) -15 bar (or atm)
(C) -31 bar (or atm)
(D) -10,000 bar (or atm)

31. What is the basic concept of agricultural drainage?
(A) Supplying supplemental irrigation water to dry field soils
(B) Increasing the groundwater table depth for capillary rise
(C) Diverting natural river water channels into crop fields
(D) Removal of excess water from the plant root zone

32. Which type of sub-surface drainage system is highly suitable and cost-effective for heavy clay soils where installing underground pipes is difficult?
(A) Open ditch drainage
(B) Tile drainage
(C) Mole drainage
(D) Pump drainage

33. Consider the following statements regarding drainage systems:
I. Surface drainage removes excess water from the soil surface before it enters the soil profile.
II. Sub-surface drainage systems primarily utilise open unlined ditches to rapidly flush surface runoff.
III. Tile drains are laid underground at a specific gradient to facilitate sub-surface drainage.
Which of the above statements is/are incorrect?
(A) I and II only
(B) II only
(C) I and III only
(D) III only

34. What is the primary negative effect of waterlogging on the soil environment in the crop root zone?
(A) It drastically increases the oxygen diffusion rate
(B) It leads to the rapid oxidation of soil organic matter
(C) It increases the availability of nitrate-nitrogen due to enhanced nitrification
(D) It replaces soil air with water, causing anaerobic conditions

35. Which specific biochemical process results in the massive loss of soil nitrogen to the atmosphere in severely waterlogged soils?
(A) Denitrification
(B) Nitrification
(C) Ammonification
(D) Nitrogen fixation

36. In the canal-irrigated Sharda Sahayak command area of Uttar Pradesh, vast tracts of agricultural land have become barren. What is the primary cause of this problem?
(A) Severe wind erosion removing fertile topsoil layers
(B) Over-extraction of groundwater causing major aquifer depletion
(C) Canal seepage causing waterlogging and salinity
(D) Intensive and continuous mono-cropping of pulse crops

37. To prevent root zone suffocation in most field crops, the groundwater table should ideally be maintained at a minimum depth of:
(A) 10 to 20 cm below the surface
(B) 30 to 45 cm below the surface
(C) 100 to 150 cm below the surface
(D) Exactly at the soil surface

38. A drainage channel constructed across a slope to intercept and safely divert surface runoff coming from higher elevated lands is known as a:
(A) Relief drain
(B) Tile drain
(C) Mole drain
(D) Interceptor drain

39. Match the drainage terminology in List I with its description in List II.
List I: (Drainage Terminology)
P. Mole drain
Q. Tile drain
R. Vertical drainage
S. Surface drainage
List II: (Description)
1. Pumping out water using deep tube wells to lower the water table
2. Underground pipes made of clay or perforated plastic
3. Land grading and open ditches

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R. 1 Hectare-centimetre
S. 1 Hectare-metre
List II: (Equivalent Value)
1. 100,000 litres
2. 10,000,000 litres
3. 28.32 litres per second
4. 1,000 litres per second
(A) P-3, Q-4, R-1, S-2
(B) P-4, Q-3, R-2, S-1
(C) P-3, Q-4, R-2, S-1
(D) P-1, Q-2, R-3, S-4

78. Select the odd one out from the following list of irrigation equipment components:
(A) Micro-tube emitter
(B) Screen filter
(C) Mouldboard plough
(D) Pressure relief valve

79. During the ripening phase of sugarcane, irrigation is intentionally withheld or severely restricted approximately how many days before harvest to facilitate sugar accumulation?
(A) 5 to 10 days
(B) 15 to 25 days
(C) 60 to 75 days
(D) Irrigation is never withheld before harvest

80. Consider the following statements regarding the implementation of the micro-irrigation subsidy scheme in Uttar Pradesh:
I. Subsidies are disbursed directly into the bank accounts of eligible farmers through Direct Benefit Transfer (DBT).
II. Small and marginal farmers are eligible for a higher percentage of subsidy compared to large farmers.
III. The scheme exclusively supports corporate farming entities and prohibits individual farmers from applying.
Which of the above statements is/are correct?
(A) I and II only
(B) II and III only
(C) I and III only
(D) I, II and III

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(D) Biochemical Oxygen Demand

51. In the context of watershed management, which of the following best defines a 'watershed'?
(A) A land area draining all runoff water to a common point
(B) A large concrete reservoir designed for municipal water storage
(C) An artificial canal system built for delivering irrigation water
(D) A highly saline inland waterbody lacking any natural drainage outlet

52. The basic principle of watershed management dictates that soil and water conservation measures should commence from the:
(A) Lowest point in the valley and move upwards
(B) Middle of the catchment area extending outwards
(C) Ridge line and move downwards to the valley
(D) Mouth of the river progressing inland

53. Consider the following statements regarding the objectives and principles of watershed management:
I. Watershed management aims to increase groundwater recharge through in-situ moisture conservation.
II. It exclusively focuses on water conservation, ignoring crop production and animal husbandry.
III. It involves controlling soil erosion to reduce sediment load in streams and reservoirs.
IV. It promotes the concept of participatory management involving the local community.
Which of the above statements is/are incorrect?
(A) I and III only
(B) II only
(C) III and IV only
(D) IV only

54. Which of the following is a common agronomic measure used for in-situ rainwater harvesting in dryland agriculture?
(A) Deep tubewell extraction system
(B) Concrete lining of major canal networks
(C) Continuous intensive rotary tillage
(D) Broadbed and furrow system

55. What is the primary purpose of constructing a check dam in a small stream or gully?
(A) To completely block the natural stream flow and create a massive storage reservoir
(B) To slow water velocity, retain sediment, and recharge groundwater
(C) To act as an elevated aqueduct carrying canal water across a natural drainage line
(D) To permanently divert the entire stream discharge directly into another river basin

56. The total geographical area that drains precipitation into a specific river, stream, or reservoir is officially known as its:
(A) Command area
(B) Aquifer zone
(C) Catchment area
(D) Riparian buffer

57. Which of the following represents the correct sequence of water erosion stages, from initial raindrop impact to severe channelisation?
(A) Splash erosion → Rill erosion → Sheet erosion → Gully erosion
(B) Sheet erosion → Splash erosion → Gully erosion → Rill erosion
(C) Splash erosion → Sheet erosion → Rill erosion → Gully erosion
(D) Rill erosion → Gully erosion → Splash erosion → Sheet erosion

58. Farm ponds are constructed to harvest rainwater. In highly porous soils, excessive seepage loss from farm ponds can be effectively controlled by lining the bottom with:
(A) Bentonite clay or LDPE film
(B) Coarse river sand and fine gravel layers
(C) Chopped dry crop residue and organic mulch
(D) Highly porous fractured laterite rock beds

59. Rooftop rainwater harvesting systems in urban and peri-urban areas are primarily promoted by the government to:
(A) Generate electricity
(B) Recharge declining groundwater aquifers
(C) Supply water for heavy industrial manufacturing
(D) Create artificial surface lakes for tourism

60. Percolation tanks are surface water bodies designed to augment groundwater. For a percolation tank to be effective, the underlying geological formation must be:
(A) Highly impermeable continuous hard rock formations
(B) Porous bedrock or permeable soil
(C) Thick impermeable deposits of dense heavy clay
(D) Highly compacted saline-sodic soil horizons

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(A) I and II only
(B) I, II and III only
(C) II, III and IV only
(D) I, II, III and IV

19. If the application rate of a sprinkler irrigation system exceeds the basic infiltration rate of the soil, what will be the immediate consequence?
(A) Surface runoff and potential soil erosion
(B) Rapid increase in deep percolation
(C) Immediate salt accumulation on the soil surface
(D) Enhanced root zone aeration

20. Under the Pradhan Mantri Krishi Sinchayee Yojana (PMKSY) component 'Per Drop More Crop', micro-irrigation systems are promoted. What is the primary focus of this component?
(A) Constructing large multi-purpose storage dams
(B) Expanding the nationwide major canal network
(C) Improving farm-level water use efficiency
(D) Interlinking major perennial river systems

21. Which critical stage of wheat crop growth requires the first and most essential irrigation, usually falling 21 days after sowing?
(A) Crown Root Initiation stage
(B) Active stem jointing stage
(C) Crop flowering and anthesis stage
(D) Grain milking and filling stage

22. In the life cycle of a sugarcane crop grown in Uttar Pradesh, the formative phase generally occurs during which time frame after planting?
(A) 0 to 45 days
(B) 60 to 130 days
(C) 130 to 250 days
(D) 250 to 300 days

23. What term is used to describe the total quantity of water required by a crop from the time of sowing to harvesting, including evapotranspiration and water used for metabolic activities?
(A) Water requirement
(B) Consumptive use
(C) Irrigation requirement
(D) Net irrigation requirement

24. Which instrument is traditionally used in agricultural research stations to measure actual evapotranspiration of a crop in the field?
(A) Tensiometer
(B) Piezometer
(C) Lysimeter
(D) Hygrometer

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25. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): Moisture stress during the grand growth phase of sugarcane severely restricts internode elongation and reduces cane yield.
Reason (R): The grand growth phase coincides with the monsoon season when water demand naturally drops to a minimum.
(A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).
(B) Both Assertion (A) and Reason (R) are true but Reason (R) is not the correct explanation of Assertion (A).
(C) Assertion (A) is true but Reason (R) is false.
(D) Assertion (A) is false but Reason (R) is true.

26. Which formula is used to calculate the Irrigation Requirement (IR) of a crop?
(A) IR = Water Requirement - (Effective Rainfall + Soil Moisture Contribution)
(B) IR = Consumptive Use - Effective Rainfall
(C) IR = Water Requirement + Effective Rainfall
(D) IR = Consumptive Use + Deep Percolation

27. The ratio between the depth of irrigation water applied (IW) and the cumulative pan evaporation (CPE) is often used to schedule irrigations. For a highly water-sensitive crop, the IW/CPE ratio is generally:
(A) Less than 0.2
(B) Between 0.3 and 0.4
(C) Close to 1.0 or slightly higher
(D) Always equal to 0.0

28. Which of the following crops has the highest overall total water requirement during its entire crop duration?
(A) Wheat
(B) Sugarcane
(C) Potato
(D) Mustard

29. During periods of limited water availability, applying irrigation only at the most critical growth stages of a crop is an example of:
(A) Deficit irrigation
(B) Luxury water consumption
(C) Surge irrigation method

Which of the above statements is/are correct?
(A) I and II only
(B) II and III only
(C) I and III only
(D) I, II and III

70. Which of the following is the correct sequence of soil moisture constants arranged in decreasing order of moisture availability to plants?
(A) Permanent Wilting Point → Field Capacity → Saturation Capacity
(B) Saturation Capacity → Field Capacity → Permanent Wilting Point
(C) Field Capacity → Saturation Capacity → Permanent Wilting Point
(D) Saturation Capacity → Permanent Wilting Point → Field Capacity

71. In sugarcane cultivation, the pit method (ring pit method) of planting is known to save irrigation water and give high yields. In this method, water is generally applied:
(A) By flooding the entire field up to 10 cm depth
(B) Only within the pits, leaving the inter-row space dry
(C) By spraying water over the crop canopy
(D) By running water continuously through deep trenches across the field

72. Applying a thick layer of dry sugarcane trash (trash mulching) in the inter-row spaces of a ratoon sugarcane crop primarily helps in water management by:
(A) Substantially increasing surface runoff during heavy rainfall
(B) Elevating total crop transpiration rates throughout growth
(C) Reducing moisture loss via evaporation
(D) Completely eliminating the need for all subsequent field irrigations

73. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): Adopting drip irrigation in sugarcane enhances sugar recovery percentages compared to traditional flood irrigation.
Reason (R): Drip irrigation avoids alternating cycles of waterlogging and severe moisture stress, allowing controlled moisture regulation crucial for proper cane ripening.
(A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).
(B) Both Assertion (A) and Reason (R) are true but Reason (R) is not the correct explanation of Assertion (A).
(C) Assertion (A) is true but Reason (R) is false.
(D) Assertion (A) is false but Reason (R) is true.

74. The cultural operation of 'earthing up' in sugarcane, usually done at the time of final inter-cultivation, serves which dual purpose in terms of water management?
(A) It creates ridges and furrows for irrigation and monsoon drainage
(B) It flattens the soil bed for basin irrigation while exposing upper root systems
(C) It completely seals the soil surface layer to stop rainwater infiltration
(D) It excavates deep circular retention pits to hold excess floodwater for months

75. Consider the following statements regarding advanced water management practices in sugarcane:
I. Application of potassium fertilisers enhances the drought tolerance of the sugarcane crop.
II. In areas with water scarcity, planting in deep trenches rather than flat beds helps conserve moisture.
III. Skipping alternate furrows during irrigation is an effective practice to stretch limited water resources.
IV. Irrigating continuously until standing water remains for 15 days is recommended for maximizing tillering.
Which of the above statements is/are correct?
(A) I, II and III only
(B) I and III only
(C) II, III and IV only
(D) I, II, III and IV

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76. The Crop Coefficient (Kc) value, used to estimate crop evapotranspiration, is highest for sugarcane during which physiological stage?
(A) Initial germination phase
(B) Peak grand growth phase
(C) Late maturity and ripening phase
(D) Post-harvest stubble phase

77. Match the water measurement units in List I with their corresponding equivalent values in List II.
List I: (Water Measurement Unit)
P. 1 Cusec (cubic foot per second)
Q. 1 Cumec (cubic metre per second)

4. Unlined circular channels formed deep in clay soils by a special plough

(A) P-4, Q-2, R-1, S-3
(B) P-2, Q-4, R-3, S-1
(C) P-4, Q-2, R-3, S-1
(D) P-1, Q-2, R-4, S-3

40. Which of the following is a common indicator plant species that thrives in poorly drained, waterlogged soils?
(A) Cactus
(B) Acacia
(C) Typha
(D) Prosopis

41. The suitability of water for irrigation is often assessed using the Sodium Adsorption Ratio (SAR). Which of the following formulas correctly represents SAR?
(A) $Na^+ / (Ca^{2+} + Mg^{2+})$
(B) $(Ca^{2+} + Mg^{2+}) / Na^+$
(C) $Na^+ / (Ca^{2+} + Mg^{2+} + K^+)$
(D) $Na^+ / \sqrt{((Ca^{2+} + Mg^{2+})/2)}$

42. According to standard irrigation water quality classifications, water with an SAR value of less than 10 is considered:
(A) Low sodium water (safe for almost all soils)
(B) Medium sodium water
(C) High sodium water
(D) Very high sodium water (unsuitable for irrigation)

43. Residual Sodium Carbonate (RSC) is a crucial parameter for determining irrigation water quality. Irrigation water is generally considered safe if the RSC value is less than:
(A) 1.25 meq/L
(B) 2.50 meq/L
(C) 5.00 meq/L
(D) 10.0 meq/L

44. What is the standard threshold concentration of Boron in irrigation water above which it becomes highly toxic to most sensitive crops?
(A) 0.1 ppm
(B) 1.0 to 1.5 ppm
(C) 5.0 to 6.0 ppm
(D) 10.0 to 15.0 ppm

45. To manage soils irrigated with saline water and prevent the accumulation of salts in the root zone, farmers must apply excess water. This practice is based on the concept of:
(A) Leaching requirement
(B) Sub-soiling
(C) Capillary fringe management
(D) Moisture tension regulation

46. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): Gypsum is frequently applied as an amendment to soils that are continuously irrigated with high SAR water.
Reason (R): Gypsum supplies calcium which readily replaces exchangeable sodium on the soil clay complex, allowing the sodium to be leached out.
(A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).
(B) Both Assertion (A) and Reason (R) are true but Reason (R) is not the correct explanation of Assertion (A).
(C) Assertion (A) is true but Reason (R) is false.
(D) Assertion (A) is false but Reason (R) is true.

47. Electrical Conductivity (EC) is an indicator of the total dissolved salts in water. Good quality irrigation water usually has an EC value in the range of:
(A) Less than 0.25 dS/m
(B) 0.75 to 2.25 dS/m
(C) 2.25 to 5.00 dS/m
(D) Above 5.00 dS/m

48. Which of the following crops is classified as highly tolerant to salinity in irrigation water?
(A) Onion
(B) Green gram
(C) Barley
(D) Pea

49. Continuous use of irrigation water containing high levels of carbonates and bicarbonates relative to calcium and magnesium leads to the development of which type of problem soil?
(A) Strongly acidic soil
(B) Sodic soil
(C) Organic peaty soil
(D) Weathered lateritic soil

50. Which of the following parameters is NOT primarily used as a chemical criterion for classifying the quality of irrigation water?
(A) Electrical Conductivity (EC)
(B) Sodium Adsorption Ratio (SAR)
(C) Residual Sodium Carbonate (RSC)

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ANSWERS

1. (B) Tube wells
Tube wells constitute the primary source of irrigation in Uttar Pradesh, accounting for over seventy percent of the total net irrigated area. Private and public tube wells dominate agricultural water delivery across the state due to widespread groundwater accessibility in the Indo-Gangetic plains, offering reliable on-demand water supply compared to surface canal systems.

2. (D) Check basin method
Check basin irrigation involves dividing the field into small rectangular or square level plots surrounded by low earth bunds. Water is applied quickly to each basin to submerge the soil surface evenly. This method is exceptionally suited for close-growing field crops like wheat, barley, and pulses cultivated on relatively flat agricultural topography.

3. (C) I and III only
Furrow irrigation is highly effective for row crops like sugarcane and potato because water flows along channels without submerging crop stems. Border strip irrigation works well on medium to heavy soils with gentle uniform slopes. Check basin irrigation generally exhibits lower water application efficiency than pressurized micro-irrigation systems due to significant deep percolation.

4. (C) To inject liquid fertilisers into the irrigation line
A venturi injector operates on the principle of differential pressure created by a constricted fluid path. As irrigation water passes through the narrow throat, flow velocity increases while static pressure decreases, creating a vacuum that draws liquid fertilizer from an external reservoir directly into the main irrigation line for precise fertigation.

5. (A) High wind velocity reduces water distribution uniformity
Sprinkler irrigation simulates natural rainfall by spraying water into the air through nozzles. High wind velocity significantly alters the trajectory of water droplets, causing uneven distribution patterns, distorted coverage overlap, and increased evaporation losses before droplets reach the soil surface, thereby significantly reducing overall water application efficiency in windy agricultural environments.

6. (A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).
Skip-furrow irrigation in sugarcane involves applying water to alternate furrows rather than every furrow, which directly reduces the total wetted surface area exposed to evaporation. This practice saves approximately thirty to forty percent of irrigation water without impacting cane growth, proving that alternate furrow watering effectively drives water conservation in field cultivation.

7. (C) 40 to 60 percent
Drip irrigation supplies water slowly and precisely to the crop root zone through emitters, minimizing conveyance, evaporation, deep percolation, and runoff losses. Compared to traditional flood irrigation methods, drip systems typically achieve water savings ranging between forty and sixty percent while simultaneously improving crop yield and overall fertilizer application efficiency.

8. (C) Furrow method
Since sugarcane is planted in rows, the furrow method represents the most practical, economic, and water-efficient surface irrigation technique for commercial adoption in Uttar Pradesh. Water flows only through furrows formed between ridges, wetting root zones while minimizing soil crusting, surface runoff, and evaporation losses compared to broad field flooding.

9. (D) Bundelkhand Region
The Bundelkhand region of Uttar Pradesh features undulating topography, hard crystalline bedrock, and shallow soil depth, which impede deep groundwater extraction via tube wells. Consequently, harvesting surface runoff in traditional ponds and earthen tanks has historically served as the most prevalent irrigation

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method to store rainwater for agriculture across this zone.

10. (A) Intermittent on-off application of water in cycles
Surge irrigation is a specialized variation of surface furrow or border irrigation where water is applied intermittently in cyclic on-off periods. During the off period, fine soil particles settle and seal soil pores, reducing intake rates and allowing subsequent surges of water to advance rapidly across fields with improved distribution uniformity.

11. (C) 1500 to 2500 mm
Sugarcane is a long-duration, high-water-consuming C4 crop requiring continuous moisture availability throughout its extended vegetative and formative development. In sub-tropical regions like North India, a standard 12-month crop consumes approximately 1500 to 2500 millimeters of water, depending on climatic parameters, evapotranspiration rates, soil texture, and field management practices employed during growth.

12. (A) 3-1-4-5-2
In a functional drip irrigation system, water pumped from a source first enters media or screen filtration systems to eliminate particulate debris. Cleaned water then flows sequentially into the main line, branches into sub-main pipes, enters flexible lateral tubing laid along crop rows, and is finally discharged slowly into root zones via emitters.

13. (A) Formative phase
The formative phase, occurring roughly 60 to 130 days after planting, is the most critical growth period for sugarcane moisture demand. During this stage, tiller production, leaf canopy expansion, and root development take place. Moisture stress during this phase leads to severe tiller mortality, reduced shoot density, and irreversible loss in final cane yield.

14. (C) Drip irrigation
Fertigation integrates plant nutrition with irrigation, delivering dissolved water-soluble fertilizers directly to the active root zone. Drip irrigation provides the highest fertigation efficiency because water application is precise, frequent, and uniform, preventing nutrient leaching below the root zone, reducing volatilization losses, and allowing customized nutrient dosing according to crop growth.

15. (D) Crop Yield divided by Evapotranspiration
Crop Water Use Efficiency is defined as the ratio of economic yield produced by a crop to the total seasonal evapotranspiration loss. Expressed mathematically as Crop Yield divided by Evapotranspiration, this metric measures how effectively a crop converts water consumed through transpiration and soil evaporation into harvestable agricultural produce under field conditions.

16. (A) P-3, Q-1, R-2, S-4
Drip irrigation is ideal for wide-spaced orchards and vegetables in water-scarce regions due to localized delivery. Sprinkler irrigation suits undulating topography and sandy soils where surface runoff or deep percolation is high. Furrow irrigation is designated for row crops like potato and sugarcane, while check basin suits close-growing wheat on flat terrain.

17. (B) Hydrochloric acid
Emitters in drip irrigation systems frequently become clogged due to chemical precipitates such as calcium carbonate and magnesium salts. Injecting dilute hydrochloric acid lowers irrigation water pH, successfully dissolving mineral deposits and scale within lateral lines and emitter orifices, thereby restoring uniform discharge rates and extending the overall operational life of drip components.

18. (B) I, II and III only
Micro-irrigation minimizes weed growth by wetting only target soil zones rather than entire field surfaces, while targeted fertigation significantly boosts nutrient efficiency. Furthermore, low application rates make micro-irrigation suitable for low-infiltration soils. However, micro-irrigation generally operates under low pressure, reducing operational energy costs rather than significantly increasing overall energy expenditure.

19. (A) Surface runoff and potential soil erosion
When the precipitation or application rate of a sprinkler irrigation system exceeds the basic infiltration capacity of the soil, the soil surface cannot absorb water quickly enough. The excess unabsorbed water accumulates on the surface, generating immediate overland surface runoff,

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which frequently leads to topsoil detachment and severe agricultural soil erosion.

20. (C) Improving farm-level water use efficiency
The 'Per Drop More Crop' component of Pradhan Mantri Krishi Sinchayee Yojana focuses primarily on enhancing farm-level water use efficiency through the adoption of micro-irrigation systems like drip and sprinkler technologies. It emphasizes precision water management, reducing water wastage, promoting fertigation, and boosting crop productivity per unit of water applied.

21. (A) Crown Root Initiation stage
The Crown Root Initiation stage, occurring approximately twenty-one days after sowing, is the most critical growth phase for wheat irrigation. Crown roots anchor the plant and supply nutrients for tillering. Severe moisture stress during this stage permanently restricts root branching and tiller formation, causing drastic reductions in overall crop yield.

22. (B) 60 to 130 days
In sub-tropical environments like Uttar Pradesh, the life cycle of sugarcane is divided into germination, formative, grand growth, and maturity phases. The formative phase occurs between 60 and 130 days after planting. This stage is characterized by intense tillering, root proliferation, and early canopy setup, demanding optimal soil moisture management.

23. (B) Consumptive use
Consumptive use refers to the total volume of water consumed by a crop through transpiration from plant tissues, evaporation from adjacent soil surfaces, and water retained within plant tissues for metabolic activities throughout the growing season. It serves as a fundamental benchmark for determining net crop water requirements in irrigation engineering.

24. (C) Lysimeter
A lysimeter is a specialized meteorological device used to quantify actual crop evapotranspiration by measuring the hydrological balance within an isolated, vegetated soil column. By accurately recording soil water input, percolation, drainage, and weight changes, lysimeters provide precise measurements of combined water losses from plant transpiration and soil surface evaporation.

25. (C) Assertion (A) is true but Reason (R) is false.
Moisture stress during the grand growth phase restricts cane cell elongation, internode expansion, and total biomass accumulation, severely reducing cane yield. However, the grand growth phase coincides with peak summer and monsoon periods where crop water demand reaches maximum, not minimum, making the supporting reason false despite the assertion being true.

26. (A) IR = Water Requirement - (Effective Rainfall + Soil Moisture Contribution)
The net Irrigation Requirement of a crop represents the artificial depth of water needed to satisfy crop water needs after accounting for natural supplies. It is calculated by subtracting the sum of effective rainfall and available capillary soil moisture contribution from the total water requirement of the crop during growth.

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27. (C) Close to 1.0 or slightly higher
The IW/CPE ratio serves as a scientific approach for scheduling crop irrigation based on atmospheric evaporative demand. Highly water-sensitive crops require frequent irrigations to prevent soil moisture stress. Consequently, their optimal IW/CPE ratio is maintained close to 1.0 or slightly higher to ensure moisture levels near field capacity throughout growth.

28. (B) Sugarcane
Sugarcane exhibits the highest overall total water requirement among major field crops due to its long life cycle spanning twelve to eighteen months and massive green biomass production. Consuming between 1500 and 2500 millimeters of water per crop cycle, sugarcane far exceeds the total irrigation needs of seasonal field crops.

29. (A) Deficit irrigation
Deficit irrigation is an optimization strategy where water application is deliberately restricted below full evapotranspiration requirements, focusing irrigation exclusively during sensitive moisture-critical growth stages. This strategy maximizes water productivity, conserves limited water supplies, and stabilizes crop yields under water-scarce conditions without causing severe crop yield reductions associated with drought stress.

(C) P-2, Q-1, R-4, S-3
(D) P-1, Q-4, R-2, S-3

19. Which of the following acts is specifically designed to regulate the import, manufacture, sale, transport, distribution, and use of insecticides with a view to prevent risk to human beings or animals?
(A) The Insecticides Act, 1968
(B) The Environment (Protection) Act, 1986
(C) The Water (Prevention and Control of Pollution) Act, 1974
(D) The Biological Diversity Act, 2002

20. Which of the following machinery is highly recommended by the government under crop residue management schemes for direct sowing of wheat without burning paddy stubble?
(A) Laser Land Leveler
(B) Reaper Binder
(C) Happy Seeder
(D) MB Plough

21. Which is the safest and environmentally sound method for the disposal of empty pesticide containers at the farm level?
(A) Puncturing and burying them deep in barren land away from water
(B) Thoroughly washing them with canal water and reusing washings for crop irrigation
(C) Thoroughly cleaning and reusing them for storing domestic drinking water at home
(D) Burning them openly along with dry field crop residue during post-harvest clearing

22. Consider the following statements regarding the ecological importance of agricultural biodiversity:
I. It enhances the resilience of farming systems against pests and climate shocks.
II. It completely relies on monocropping practices to maintain soil micro-flora.
III. It provides a broader genetic base for breeding new crop varieties.
Which of the above statements is/are correct?
(A) I and II only
(B) II and III only
(C) I and III only
(D) I, II and III

23. What is the primary purpose of the 'Gobardhan Scheme' (Galvanizing Organic Bio-Agro Resources Dhan) launched by the Government of India?
(A) Providing heavily subsidized chemical fertilizers and micronutrients to marginal farmers
(B) Converting cattle dung and farm waste into biogas and bio-slurry
(C) Distributing high-yielding breeds of milch cattle and poultry to rural households
(D) Subsidizing the purchase of heavy agricultural machinery and modern implements

24. Which of the following is NOT a characteristic feature of biological pesticides?
(A) They are highly target-specific, affecting only intended pest species
(B) They decompose rapidly in the environment without leaving toxic residues
(C) Long-term soil persistence causing biomagnification
(D) They generally exhibit minimal impact on beneficial non-target insects

25. Which of the following represents the correct hierarchical order of waste management strategies in agriculture, from most preferred to least preferred?
(A) Reuse, Reduce, Recycle, Dispose
(B) Reduce, Reuse, Recycle, Dispose
(C) Recycle, Dispose, Reduce, Reuse
(D) Dispose, Recycle, Reuse, Reduce

26. Precision agriculture helps in environmental conservation primarily by:
(A) Applying inputs like water and fertilizers precisely where needed
(B) Eliminating the requirement for manual field labour and supervision entirely
(C) Cultivating genetically identical crop monocultures over vast continuous tracts
(D) Increasing overall dependency on deep and frequent heavy tillage operations

27. Which byproduct of sugar mills is widely utilized as an excellent organic soil amendment to reclaim alkaline soils and supply essential nutrients?
(A) Bagasse
(B) Press mud
(C) Molasses
(D) Distillery spent wash (untreated)

28. Which of the following diseases in sugarcane is effectively managed by the biological control agent Trichoderma harzianum, thereby reducing the need for chemical fungicides?
(A) Grassy shoot
(B) Red rot

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40. (C) Typha
Typha, commonly known as cattail or bulrush, is an aquatic or semi-aquatic macrophyte that thrives in poorly drained, marshy, and chronically waterlogged soils. Possessing specialized aerenchyma tissues that facilitate internal oxygen transport to submerged roots, Typha serves as a biological indicator plant for waterlogged environments, wetlands, and waterlogged canal banks.

41. (D) $Na^+ / \sqrt{((Ca^{2+} + Mg^{2+})/2)}$
Sodium Adsorption Ratio measures the relative concentration of sodium ions to calcium and magnesium ions in irrigation water, expressed in milliequivalents per liter. The mathematical formula calculates sodium concentration divided by the square root of half the sum of calcium and magnesium concentrations, assessing potential sodium hazard and soil structural breakdown.

42. (A) Low sodium water (safe for almost all soils)
In standard agricultural water quality classification, water exhibiting a Sodium Adsorption Ratio value below 10 is categorized as low sodium water. This water presents minimal sodium hazard, poses little risk of developing sodic soil conditions, and is considered safe for continuous irrigation on almost all crop species and soil types.

43. (A) 1.25 meq/L
Residual Sodium Carbonate measures the excess of carbonate and bicarbonate ions over calcium and magnesium ions in irrigation water. Water with an RSC value less than 1.25 milliequivalents per liter is considered safe for agricultural irrigation, as it does not cause severe precipitation of calcium and magnesium or soil sodicity.

44. (B) 1.0 to 1.5 ppm
Boron is an essential micronutrient required in trace amounts for plant physiological functions, but its safety margin in irrigation water is narrow. Concentration levels exceeding 1.0 to 1.5 parts per million in irrigation water become highly toxic to sensitive crops, resulting in leaf tip burn, chlorosis, necrosis, and reduced crop yield.

45. (A) Leaching requirement
The leaching requirement is the fraction of total applied irrigation water that must pass through and beyond the root zone to dissolve and flush out accumulated soluble salts. Applying this additional water fraction maintains soil salinity within crop tolerance thresholds, preventing salt accumulation that would otherwise impair plant root osmotic absorption.

46. (A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).
Applying agricultural gypsum to fields irrigated with high sodium adsorption ratio water supplies soluble calcium ions. These calcium ions displace exchangeable sodium adsorbed on clay exchange sites. Displaced sodium converts into soluble sodium sulfate, which leaches out of the root zone with excess irrigation water, effectively restoring soil physical structure.

47. (A) Less than 0.25 dS/m
Electrical conductivity measures the concentration of total dissolved salts in water and serves as a standard metric for water salinity evaluation. Water with an electrical conductivity value less than 0.25 deciSiemens per meter is classified as excellent or low-salinity irrigation water, posing minimal osmotic stress or toxicity risk to crops.

48. (C) Barley
Barley is classified as a highly salinity-tolerant cereal crop capable of producing satisfactory yields under high soil and irrigation water salinity conditions. Its osmotic adjustment mechanisms, physiological ion exclusion capability, and tissue tolerance enable it to withstand elevated root zone salt concentrations that severely inhibit salt-sensitive pulses and vegetable crops.

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49. (B) Sodic soil
Continuous irrigation using water high in carbonates and bicarbonates precipitates soluble calcium and magnesium as insoluble carbonate compounds. This removal of divalent cations leaves sodium ions dominant in the soil solution, increasing exchangeable sodium percentage and causing clay dispersion, high pH, poor permeability, and structural degradation characteristic of sodic soils.

50. (D) Biochemical Oxygen Demand
Biochemical Oxygen Demand measures organic pollution and oxygen consumption by microorganisms in surface water, serving as an

environmental wastewater quality parameter. Chemical criteria for evaluating agricultural irrigation water suitability focus on inorganic parameters including Electrical Conductivity, Sodium Adsorption Ratio, Residual Sodium Carbonate, toxic ion concentrations, and specific chemical ion ratios.

51. (A) A land area draining all runoff water to a common point
A watershed is defined as a topographically delineated geohydrological land unit that drains all precipitation and surface runoff water falling within its boundary to a single common outlet or point, such as a stream, river, lake, or wetland, forming a unified natural hydrological system for land and water resource management.

52. (C) Ridge line and move downwards to the valley
The fundamental cardinal principle of integrated watershed management requires treatment measures to start from the top ridge line and progress downward toward the lower valley. Treating upper ridge slopes controls runoff velocity, prevents soil erosion at its source, reduces sediment accumulation in lower channels, and protects downstream water storage structures.

53. (B) II only
Watershed management adopts an integrated multi-disciplinary approach that combines soil and moisture conservation, groundwater recharge, crop production, forestry, and animal husbandry within a hydrological unit. It emphasizes community participation and soil erosion control. Claiming that it focuses exclusively on water conservation while ignoring farming and livestock is fundamentally incorrect and inaccurate.

54. (D) Broadbed and furrow system
The broadbed and furrow system is a prominent agronomic land-configuration technique for in-situ rainwater harvesting and soil moisture conservation in rainfed and dryland farming. Alternating wide raised beds with furrows encourages infiltration into root zones during normal rains while directing excess runoff safely during heavy rainfall events without causing erosion.

55. (B) To slow water velocity, retain sediment, and recharge groundwater
A check dam is a small temporary or permanent barrier constructed across a drainage ditch, gully, or stream. Its primary objective is to decrease runoff velocity, trap suspended sediment, induce soil deposition, reduce channel erosion, and store surface water temporarily to facilitate localized groundwater recharge within the watershed catchment area.

56. (C) Catchment area
The total geographical area contributing surface runoff and precipitation drainage into a specific river, natural stream, stream branch, or artificial water storage reservoir is officially designated as its catchment area. Topographic divides define this area, determining total water yield, peak discharge rates, and hydrological balance within the natural drainage system.

57. (C) Splash erosion → Sheet erosion → Rill erosion → Gully erosion
Water erosion progresses through four sequential stages based on kinetic energy and channel depth. Raindrop impact first initiates splash erosion by dislodging fine soil particles. Water accumulation then causes uniform thin surface removal known as sheet erosion. As runoff concentrates, small micro-channels or rills form, which eventually enlarge into massive gullies.

58. (A) Bentonite clay or LDPE film
Farm ponds constructed on highly porous, coarse-textured soils experience severe seepage losses through permeable bed layers. Lining pond bottoms and sidewalls with low-permeability materials like bentonite clay or synthetic Low-Density Polyethylene films creates an effective impermeable barrier, drastically reducing sub-surface percolation and conserving harvested rainwater for longer seasonal crop periods.

59. (B) Recharge declining groundwater aquifers
Rooftop rainwater harvesting in urban and peri-urban regions captures clean precipitation runoff from building roofs and directs it into recharge pits, dug wells, or shafts. The primary government objective is artificially augmenting over-exploited sub-surface aquifers, counteracting rapid water table decline caused by paving, urbanization, and continuous deep groundwater extraction activities.

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60. (B) Porous bedrock or permeable soil
Percolation tanks are specialized surface storage basins designed specifically to hold surface runoff and allow it to infiltrate downwards into underlying unconfined aquifers. For effective groundwater recharge, the underlying geological stratum must consist of porous bedrock, fractured rock, or permeable soil, facilitating rapid downward vertical hydraulic conductivity without sealing pores.

61. (A) Over-exploitation of groundwater for agriculture
Western Uttar Pradesh features intensive agricultural production dominated by water-demanding cropping patterns like paddy and sugarcane. Extensive installation of private energized tube wells, coupled with groundwater abstraction rates far exceeding natural monsoon recharge rates, has caused severe over-exploitation of sub-surface aquifers, leading to critical groundwater level depletion across multiple districts.

62. (C) Recharge shaft
When a shallow impermeable clay layer overlies deeper permeable sandy aquifers, surface infiltration methods fail due to restricted vertical hydraulic conductivity. A recharge shaft is constructed by excavating or drilling through the upper impermeable clay stratum into the sandy aquifer, providing a direct vertical conduit for surface water to recharge.

63. (C) 2015
The Government of India officially launched the Pradhan Mantri Krishi Sinchayee Yojana in July 2015 to achieve end-to-end solutions in irrigation supply chains. Formulated by amalgamating ongoing schemes, PMKSY aims to extend farm irrigation coverage under 'Har Khet Ko Pani' and enhance water use efficiency through 'Per Drop More Crop'.

64. (C) Creating new water sources and restoring traditional water bodies
The "Har Khet Ko Pani" component of PMKSY specifically focuses on creating new water sources through minor irrigation projects, repairing and restoring traditional water bodies, expanding distribution networks, and tapping surface water. Its primary objective is providing assured irrigation access to unirrigated culturable command areas across agricultural farm holdings nationally.

65. (B) To bridge the gap between created and utilized irrigation potential
The Command Area Development Programme was launched in 1974-75 to optimize agricultural production in major and medium irrigation command areas. Its primary objective was bridging the substantial gap between created irrigation potential and actual field utilization by constructing field channels, carrying out land leveling, and introducing rotational water distribution systems.

66. (D) Farmer-led Water User Associations
Participatory Irrigation Management is a core pillar of the Command Area Development Programme, transferring micro-level water distribution and infrastructure maintenance below outlet points to local farmers. Water User Associations, composed of local beneficiary farmers, collectively manage equity in water allocation, collect water fees, resolve minor conflicts, and maintain field channels.

67. (B) 60:40
Under the Centrally Sponsored Scheme of Pradhan Mantri Krishi Sinchayee Yojana - Per Drop More Crop, financial funding for micro-irrigation installation subsidies in plain states like Uttar Pradesh is shared between the Central Government and State Government in a 60:40 ratio, with sixty percent provided centrally and forty percent contributed.

68. (A) P-2, Q-3, R-4, S-1
The Accelerated Irrigation Benefit Programme focuses on completing major and medium irrigation projects. Har Khet Ko Pani creates minor irrigation sources and restores traditional water bodies. Per Drop More Crop promotes precision micro-irrigation systems, while Watershed Development emphasizes ridge area treatment, soil conservation, and in-situ moisture retention across natural catchments.

69. (C) I and III only
Cultivating water-intensive crops like paddy and sugarcane accelerates groundwater depletion due to heavy abstraction. Constructing recharge trenches along drains captures surface runoff to recharge aquifers. However, lining canals eliminates seepage, which reduces, rather than

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30. (A) -0.1 to -0.33 bar (or atm)
Field capacity represents the amount of water retained in the soil after excess gravitational water has completely drained away following thorough wetting. For medium-textured agricultural soils like loams and silt loams, soil moisture tension at field capacity typically ranges between -0.1 and -0.33 bar, establishing the upper limit of plant-available water.

31. (D) Removal of excess water from the plant root zone
Agricultural drainage is the artificial or natural removal of excess surface and sub-surface water from agricultural fields, specifically targeting the plant root zone. Removing excess water lowers elevated water tables, restores adequate soil aeration, prevents root suffocation, prevents salt accumulation, and creates optimal physical soil conditions required for crop development.

32. (C) Mole drainage
Mole drainage is an unlined sub-surface drainage technique implemented in cohesive clay soils. A cylindrical mole plough is pulled through the subsoil, creating continuous underground circular channels without installing perforated pipes. This method provides an economical and effective drainage solution for heavy clay soils characterized by low permeability and high cohesion.

33. (B) II only
Surface drainage removes excess standing water before it infiltrates, while tile drains use underground perforated pipes to lower sub-surface water tables. Sub-surface drainage relies on buried conduits or mole channels rather than open unlined surface ditches. Thus, the second statement is incorrect, whereas statements one and three describe systems accurately.

34. (D) It replaces soil air with water, causing anaerobic conditions
Waterlogging occurs when excess water saturates soil pores, displacing air from the pore matrix. This rapid saturation severely impairs gas exchange between the atmosphere and soil, inducing hypoxic or anaerobic conditions. Lack of oxygen stifles root respiration, halts nutrient uptake, causes toxic metabolic accumulation, and eventually leads to crop failure.

35. (A) Denitrification
Under waterlogged, anaerobic soil conditions, oxygen becomes depleted, forcing facultative and obligate anaerobic bacteria to use nitrate as an alternative electron acceptor. This biological process, known as denitrification, converts soil nitrate-nitrogen sequentially into gaseous forms like nitrous oxide and elemental nitrogen gas, which escape into the atmosphere, causing substantial plant nutrient loss.

36. (C) Canal seepage causing waterlogging and salinity
Unlined distribution canals and over-irrigation in the Sharda Sahayak command area lead to continuous sub-surface seepage, raising the shallow groundwater table close to the surface. Capillary action brings dissolved salts from deeper soil horizons to the topsoil, where water evaporates, creating secondary soil salinization and rendering large agricultural tracts waterlogged.

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37. (C) 100 to 150 cm below the surface
Maintaining an adequate unsaturated soil depth is essential for effective root aeration, microbial respiration, and healthy root development. To prevent root zone suffocation and waterlogging damage in most non-aquatic field crops, the groundwater table should ideally be maintained at a minimum depth of 100 to 150 centimeters below the surface.

38. (D) Interceptor drain
An interceptor drain is a specialized channel constructed across a land slope to capture and safely divert surface runoff or seepage water coming from higher elevated catchment areas. By intercepting excess water before it reaches lower cultivated fields, interceptor drains protect low-lying agricultural soils from flooding, erosion, and localized waterlogging.

39. (A) P-4, Q-2, R-1, S-3
Mole drainage creates unlined subterranean channels in clay subsoils using specialized mole ploughs. Tile drains use underground clay or perforated plastic pipes to lower water tables. Vertical drainage pumps water via deep tube wells to lower groundwater levels, while surface drainage utilizes land grading and open ditches for surface water removal.

development, prompting the plant to convert stored vegetative sugars into sucrose, thereby maximizing juice brix, sucrose concentration, sugar recovery percentages, and overall harvested cane commercial quality.

80. (A) I and II only
Micro-irrigation schemes in Uttar Pradesh distribute financial assistance directly to beneficiary farmers via Direct Benefit Transfer into linked bank accounts. Small and marginal farmers receive higher subsidy percentages than large landholders to encourage equitable adoption. Individual farmers are eligible applicants, making the third claim false while first two remain accurate.

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CHAPTER 18

Environmental Pollution and Conservation

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1. Which of the following greenhouse gases is predominantly emitted from submerged paddy fields due to anaerobic decomposition?
(A) Carbon dioxide
(B) Methane
(C) Nitrous oxide
(D) Chlorofluorocarbons

2. The term 'Blue Baby Syndrome' (Methemoglobinemia) in human infants is primarily caused by the contamination of drinking water with which agricultural chemical residue?
(A) Phosphates
(B) Chlorinated pesticides
(C) Sulphates
(D) Nitrates

3. Which of the following is considered a non-point source of water pollution in agriculture?
(A) Surface runoff carrying fertilizers from a catchment area
(B) Effluent discharge pipe from a sugar mill
(C) A ruptured underground chemical storage tank
(D) Discharge from an agricultural processing plant's drainage outlet

4. What is the primary environmental problem associated with the excessive application of phosphorus-rich fertilizers in agricultural fields adjacent to freshwater bodies?
(A) Ozone layer depletion
(B) Soil salinization
(C) Eutrophication
(D) Acid rain

5. The National Green Tribunal (NGT), which plays a crucial role in environmental conservation in India, was established in which year?
(A) 1986
(B) 2005
(C) 2010
(D) 2014

6. Which of the following is the most environmentally sustainable method for managing sugarcane trash after harvest?
(A) Burning the trash in the field to clear land quickly
(B) Dumping the trash in nearby surface water bodies
(C) Heaping the trash on the field boundaries to dry and decay naturally
(D) Incorporating the trash into the soil using a rotavator

7. Consider the following statements regarding the environmental impact of excessive synthetic fertilizer application:
I. It leads to nitrate contamination in groundwater.
II. It decreases the emission of nitrous oxide into the atmosphere.
III. It causes eutrophication in nearby surface water bodies.
Which of the above statements is/are correct?
(A) I and II only
(B) I and III only
(C) II and III only
(D) I, II and III

8. In the context of pollution, Biological Oxygen Demand (BOD) is primarily used as an indicator to measure which of the following?
(A) The concentration of toxic heavy metals in soil
(B) The level of particulate matter in the air
(C) The amount of organic pollution in water
(D) The quantity of pesticide residues in harvested crops

9. Sustainable Development Goal (SDG) 13 is directly related to addressing environmental challenges in agriculture. What is the core focus of SDG 13?
(A) Zero Hunger
(B) Clean Water and Sanitation
(C) Life on Land

(D) Climate Action

10. Which agricultural practice involves planting trees alongside agricultural crops to enhance biodiversity and increase farmer income?
(A) Agroforestry
(B) Monoculture
(C) Hydroponics
(D) Shifting cultivation

11. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): Stubble burning in agricultural fields significantly increases the concentration of Particulate Matter (PM2.5) in the ambient air.
Reason (R): Burning of crop residues ensures the complete return of essential soil nutrients, especially nitrogen and sulphur, to the soil profile.
(A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
(B) Both Assertion (A) and Reason (R) are true but R is not the correct explanation of A.
(C) Assertion (A) is true but Reason (R) is false.
(D) Assertion (A) is false but Reason (R) is true.

12. Which of the following organizations acts as the primary regulatory body for monitoring and controlling industrial and environmental pollution at the state level in Uttar Pradesh?
(A) Uttar Pradesh Forest Department
(B) Uttar Pradesh State Pollution Control Board (UPPCB)
(C) Central Ground Water Board (CGWB)
(D) National Environment Engineering Research Institute (NEERI)

13. Which of the following is NOT an objective of Climate-Smart Agriculture (CSA)?
(A) Maximizing the use of synthetic agrochemicals
(B) Sustainably increasing agricultural productivity and farm incomes
(C) Adapting and building agricultural resilience to climate change
(D) Reducing greenhouse gas emissions from agricultural production

14. Consider the following statements about Climate-Smart Agriculture (CSA):
I. It aims to sustainably increase agricultural productivity and incomes.
II. It focuses on adapting and building resilience to climate change.
III. It seeks to reduce and/or remove greenhouse gas emissions, where possible.
IV. It strictly prohibits the use of any form of irrigation in crop production.
Which of the above statements is/are correct?
(A) I, II and III
(B) II, III and IV
(C) I, II and IV
(D) I, III and IV

15. The phenomenon where the concentration of persistent pesticide residues, such as DDT, increases at successive higher trophic levels in a food chain is known as:
(A) Bioaccumulation
(B) Bioremediation
(C) Biosynthesis
(D) Biomagnification

16. What is the main environmental benefit of using Neem-coated urea in sugarcane cultivation?
(A) It instantly releases nitrogen into the soil profile, preventing volatilization losses
(B) It completely replaces the requirement of applying phosphatic fertilizers in crops
(C) It slows down nitrification, reducing nitrate leaching and emissions
(D) It acts as a direct biological substitute for chemical pesticides against top borer

17. Which of the following constitutes a major component of biogas generated from agricultural and animal waste?
(A) Carbon monoxide
(B) Methane
(C) Hydrogen sulphide
(D) Ammonia

18. Match List I with List II.
List I: (Greenhouse Gas)
P. Methane
Q. Nitrous Oxide
R. Carbon Dioxide
S. Ammonia (precursor to fine PM)
List II: (Primary Agricultural Source)
1. Burning of fossil fuels in farm machinery
2. Anaerobic decomposition in flooded paddy fields
3. Volatilization from urea application
4. Application of synthetic nitrogenous fertilizers
(A) P-2, Q-4, R-1, S-3
(B) P-4, Q-2, R-3, S-1

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increases, natural groundwater recharge, making the second claim false while statements one and three are correct.

70. (B) Saturation Capacity → Field Capacity → Permanent Wilting Point
Soil moisture constants reflect varying soil water content levels. Saturation capacity represents complete pore space filling with maximum moisture present. Field capacity occurs after gravitational water drains, leaving capillary water available for plant consumption. Permanent wilting point represents the lower limit of available moisture where plants wilt irreversibly, establishing decreasing availability.

71. (B) Only within the pits, leaving the inter-row space dry
In the ring pit planting method for sugarcane, circular pits are excavated in grids, and setts are planted inside them. Irrigation water is delivered specifically into individual pits rather than flooding inter-row areas. Concentrating water and nutrients solely within the active root zone reduces evaporation losses and yields water savings.

72. (C) Reducing moisture loss via evaporation
Trash mulching involves spreading a thick layer of dry sugarcane leaves in inter-row spaces. This physical protective barrier shades the soil surface from direct solar radiation, lowers soil temperature, and suppresses weed emergence. Consequently, it significantly reduces soil moisture loss through evaporation, retaining root zone soil moisture between scheduled irrigations.

73. (A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).
Drip irrigation in sugarcane enhances sugar recovery percentage by providing continuous, regulated root zone moisture without causing periodic cycles of waterlogging or severe moisture stress. Precise soil moisture regulation optimizes plant metabolic activities, encourages continuous stalk maturation, and promotes sucrose synthesis and accumulation in juice during the critical ripening phase.

74. (A) It creates ridges and furrows for irrigation and monsoon drainage
Earthing up involves mounding soil around the bases of sugarcane stalks during final inter-cultivation. This dual-purpose cultural operation forms defined ridges that support crop anchorage and erect furrows between rows. These furrows facilitate uniform water distribution during surface irrigation and act as drainage channels to discharge excess rainwater during monsoons.

75. (A) I, II and III only
Potassium application improves stomatal regulation and drought tolerance, planting in deep trenches conserves root zone moisture, and skip-furrow irrigation optimizes limited water resources. However, continuous field flooding for fifteen days induces anaerobic root zone conditions and severe root damage, making the fourth claim incorrect while the first three remain valid.

76. (B) Peak grand growth phase
The Crop Coefficient reflects the ratio of actual crop evapotranspiration to reference evapotranspiration across physiological stages. For sugarcane, Kc reaches its peak value, typically ranging between 1.15 and 1.25, during the grand growth phase due to complete canopy closure, maximum leaf area index, dense foliage, and high transpirational water demand.

77. (A) P-3, Q-4, R-1, S-2
One cusec equals a volumetric flow rate of 28.32 liters per second. One cumec equals 1,000 liters per second. One hectare-centimetre represents a total water volume of 100,000 liters spread over one hectare, while one hectare-metre equals 10,000,000 liters, establishing precise quantitative conversions between standard volumetric and discharge measurement unit standards.

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78. (C) Mouldboard plough
Micro-tube emitters, screen filters, and pressure relief valves are functional components integral to pressurized micro-irrigation systems like drip and sprinkler setups. Conversely, a mouldboard plough is a primary tillage implement used for soil inversion and seedbed preparation, serving agricultural field mechanics rather than pressurized micro-irrigation water delivery network operational systems.

79. (B) 15 to 25 days
Withholding or severely restricting irrigation fifteen to twenty-five days prior to harvesting sugarcane creates mild moisture stress. This stress halts vegetative growth and shoot

(C) Ratoon stunting
(D) Sugarcane mosaic virus

29. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): The adoption of zero-tillage technique with crop residue retention helps in reducing the carbon footprint of agriculture.
Reason (R): Zero-tillage decreases diesel consumption by tractors and minimizes the oxidation of soil organic carbon.
(A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
(B) Both Assertion (A) and Reason (R) are true but R is not the correct explanation of A.
(C) Assertion (A) is true but Reason (R) is false.
(D) Assertion (A) is false but Reason (R) is true.

30. Sustainable Development Goal (SDG) 2 specifically emphasizes the need to:
(A) Ensuring universal access to affordable, reliable, sustainable, and modern energy
(B) Protecting, restoring, and promoting the sustainable use of terrestrial ecosystems
(C) Ending hunger, achieving food security, and sustainable agriculture
(D) Ensuring sustainable and responsible consumption and production patterns worldwide

31. The uncontrolled discharge of untreated distillery effluent (spent wash) into water bodies primarily causes severe water pollution due to its:
(A) Extremely high levels of dissolved oxygen supporting aquatic flora
(B) Elevated concentrations of beneficial soil and aquatic microorganisms
(C) Significant presence of harmful radioactive chemical isotopes
(D) High Biological and Chemical Oxygen Demand

32. Which of the following weed control practices is considered most environment-friendly for sugarcane ratoon crops?
(A) Aerial spraying of broad-spectrum herbicides
(B) Complete burning of dry leaves
(C) Trash mulching between cane rows
(D) Repeated deep chemical soil fumigation

33. The 'Carbon Footprint' of an agricultural product refers to:
(A) The total physical land area required to cultivate and harvest the crop
(B) Total greenhouse gases emitted during its production lifecycle
(C) The total amount of carbon fixed in the soil profile through photosynthesis
(D) The black carbon aerosol deposits accumulated on crop leaves from pollution

34. Consider the following statements about the Pradhan Mantri KUSUM scheme:
I. It aims to promote solar energy in the agriculture sector.
II. It provides subsidies to farmers for installing standalone solar agriculture pumps.
III. It focuses on the solarization of existing grid-connected agriculture pumps.
IV. It mandates the exclusive use of diesel generators for irrigation during the night.
Which of the above statements is/are correct?
(A) I, II and IV
(B) I, II and III
(C) II, III and IV
(D) I, III and IV

35. The practice of Alternate Wetting and Drying (AWD) in paddy cultivation is an important climate-smart technology because it primarily:
(A) Reduces water consumption and methane emissions
(B) Increases the emission of methane gas
(C) Eliminates the need for nitrogenous fertilizers
(D) Prevents the occurrence of all fungal diseases

36. Which of the following is NOT an advantage of retaining crop residue on the soil surface?
(A) It conserves soil moisture
(B) It prevents soil erosion by wind and water
(C) It increases the incidence of severe crop fires
(D) It gradually increases soil organic matter content

37. Which natural resource conservation technique involves constructing small earthen barriers across the slope of the land to check surface runoff?
(A) Contour bunding
(B) Deep ploughing
(C) Flood irrigation
(D) Monocropping

38. Match List I with List II.
List I: (Environmental Terms)
P. Carbon Sequestration
Q. Biomagnification

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(B) Ministry of Environment, Forest and Climate Change
(C) Ministry of Jal Shakti
(D) Ministry of Earth Sciences

76. Match List I with List II.
List I: (Bio-control Agent/Bio-pesticide)
P. Trichogramma chilonis
Q. Bacillus thuringiensis (Bt)
R. Trichoderma harzianum
S. Nuclear Polyhedrosis Virus (NPV)
List II: (Targeted Agricultural Pest/Disease)
1. Soil-borne fungal pathogens (e.g., Wilt, Rot)
2. Sugarcane borers (egg parasitoid)
3. Helicoverpa armigera (Gram pod borer)
4. Lepidopteran caterpillars (via crystal proteins)
(A) P-2, Q-4, R-1, S-3
(B) P-4, Q-2, R-1, S-3
(C) P-2, Q-1, R-4, S-3
(D) P-1, Q-2, R-3, S-4

77. Which of the following describes a 'Climate-Smart Village'?
(A) A village using integrated practices to reduce climate risks and emissions
(B) A rural village completely dependent on imported, genetically modified seed varieties and heavy synthetic chemicals
(C) A farming village where agricultural land has been entirely replaced by commercial solar panel field installations
(D) A traditional rural settlement strictly practicing shifting cultivation and slash-and-burn farming practices

78. Identify the correct statement regarding the impact of climate change on crop water requirements:
(A) Increased atmospheric CO_2 concentration always eliminates the requirement for crop irrigation entirely across regions
(B) Climate change ensures uniformly higher rainfall across all agro-climatic zones, significantly reducing irrigation needs
(C) Elevated temperatures increase crop evapotranspiration and irrigation demand
(D) Elevated atmospheric temperatures consistently lower the overall rate of evaporation from open surface water bodies

79. The term 'In-situ' crop residue management primarily refers to:
(A) Baling the crop residue and transporting it off-farm to a nearby biomass power plant facility
(B) Burning the dry crop residue directly in the field immediately after harvest to save time
(C) Feeding the raw untreated crop residue directly to dairy livestock animals as dry fodder
(D) Managing residue within the field by incorporation or surface retention

80. Which of the following is the most direct agricultural strategy to reduce a farm's overall carbon footprint?
(A) Shifting from organic manures to entirely chemical fertilizers
(B) Increasing the frequency and depth of mechanical tillage
(C) Integrating leguminous cover crops and adopting zero tillage
(D) Leaving the soil completely bare and fallow during the summer season

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47. Which of the following irrigation methods offers the highest water use efficiency and significantly prevents groundwater depletion?
(A) Border irrigation
(B) Furrow irrigation
(C) Check basin irrigation
(D) Drip irrigation

48. Which of the following represents the correct sequence of the major greenhouse gases based on their Global Warming Potential (GWP) over a 100-year period, from lowest to highest?
(A) Carbon dioxide, Methane, Nitrous oxide
(B) Methane, Carbon dioxide, Nitrous oxide
(C) Nitrous oxide, Methane, Carbon dioxide
(D) Carbon dioxide, Nitrous oxide, Methane

49. Fly ash, a byproduct of coal-fired power plants, can be used as an agricultural soil amendment in low doses because it is a rich source of:
(A) Nitrogen and Carbon
(B) Silicon and trace elements
(C) Highly toxic persistent organic pollutants
(D) Pathogenic bacteria

50. The National Policy for Management of Crop Residues (NPMCR) strictly promotes which of the following?
(A) Safe burning of residues during night time
(B) Exporting all agricultural residues to foreign countries
(C) Replacing all cereal crops with cash crops
(D) In-situ and ex-situ management practices for crop residues

51. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): Cultivation of legume crops in a crop rotation system reduces the overall carbon footprint of farming operations.
Reason (R): Legume crops biologically fix atmospheric nitrogen, thereby reducing the requirement for industrially manufactured synthetic nitrogenous fertilizers.
(A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
(B) Both Assertion (A) and Reason (R) are true but R is not the correct explanation of A.
(C) Assertion (A) is true but Reason (R) is false.
(D) Assertion (A) is false but Reason (R) is true.

52. What is the fundamental principle of 'Vermoremediation' used for soil pollution management?
(A) Utilizing thermal heat treatments to vaporize volatility-susceptible soil contaminants
(B) Applying quicklime compounds to rapidly alter and elevate the overall soil pH level
(C) Utilizing earthworms and microbes to degrade soil pollutants
(D) Covering contaminated soil surfaces with thick plastic sheets to block solar light exposure

53. Which chemical is most commonly held responsible for the depletion of the stratospheric ozone layer, although its use in agriculture as a soil fumigant is being globally phased out?
(A) Methyl bromide
(B) Glyphosate
(C) Endosulfan
(D) Malathion

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54. Identify the INCORRECT pairing of an agrochemical category and its primary target:
(A) Herbicide - Weeds
(B) Nematicide - Roundworms/Nematodes
(C) Fungicide - Fungal pathogens
(D) Rodenticide - Insect larvae

55. Which of the following is NOT recognized as a principle of Conservation Agriculture (CA)?
(A) Minimum soil disturbance (Zero tillage)
(B) Complete burning of crop residues to sanitize the field
(C) Maintenance of permanent soil cover
(D) Diversification of crop species in sequence or association

56. Consider the following statements regarding the National Green Tribunal (NGT):
I. It was established in the year 2010.
II. It handles cases related to environmental protection and conservation of forests.
III. It provides relief and compensation for damages to persons and property due to environmental hazards.
IV. Its rulings are non-binding advisory guidelines for state governments.
Which of the above statements are correct?
(A) I, II and IV
(B) II, III and IV
(C) I, II and III
(D) I, III and IV

and its impacts globally. In agricultural contexts, this goal addresses building resilience to extreme climate variability, strengthening adaptive capacity, lowering greenhouse gas emissions through sustainable management practices, and integrating climate mitigation strategies into national policies to protect food production systems from changing environmental conditions.

10. (A) Agroforestry
Agroforestry is a land management system that intentionally integrates woody perennials, such as trees or shrubs, with agricultural crops or livestock on the same land unit. This practice improves soil structure, enhances biodiversity, increases carbon sequestration, diversifies farm revenues through timber or fruit production, and promotes ecological resilience against severe climatic fluctuations in agricultural ecosystems.

11. (C) Assertion (A) is true but Reason (R) is false.
Open stubble burning releases massive quantities of fine particulate matter and toxic gases into the atmosphere, deteriorating ambient air quality significantly. However, burning does not return nutrients efficiently; instead, complete combustion causes almost complete loss of essential organic carbon, nitrogen, and sulphur through atmospheric volatilization, while killing beneficial soil organisms and disrupting the topsoil microenvironment.

12. (B) Uttar Pradesh State Pollution Control Board (UPPCB)
The Uttar Pradesh State Pollution Control Board serves as the primary statutory regulatory agency at the state level responsible for implementing environmental laws. It monitors industrial effluent discharges, ambient air quality, and municipal waste management. UPPCB enforces compliance with anti-pollution standards, grants operating consents, and takes corrective enforcement actions against polluting entities across Uttar Pradesh.

13. (A) Maximizing the use of synthetic agrochemicals
Climate-Smart Agriculture seeks to sustainably increase agricultural productivity, adapt to climate change, and reduce greenhouse gas emissions. Maximizing synthetic agrochemicals contradicts these core principles because excessive chemical usage damages soil health, degrades water quality through nutrient runoff, and increases fossil-fuel-based industrial emissions, thereby worsening overall environmental degradation rather than mitigating climate impacts.

14. (A) I, II and III
Climate-Smart Agriculture rests on three main pillars: sustainably increasing farm productivity and incomes, enhancing crop resilience to climate variability, and mitigating agricultural greenhouse gas emissions. It actively encourages efficient water management techniques like drip or sprinkler irrigation rather than prohibiting irrigation entirely, ensuring sustainable resource utilization without compromising overall crop yields or environmental safety.

15. (D) Biomagnification
Biomagnification describes the progressive increase in the concentration of lipophilic, persistent toxic chemicals, such as DDT, within organisms at successively higher trophic levels of a food chain. Because top-level predators consume multiple lower-level organisms containing bioaccumulated toxins, synthetic residues concentrate to hazardous levels, causing severe reproductive failures and ecological harm in apex species.

16. (C) It slows down nitrification, reducing nitrate leaching and emissions
Coating urea with neem extracts acts as a natural nitrification inhibitor that inhibits soil bacteria responsible for converting ammonium into nitrate. By slowing down this chemical transformation, nitrogen availability matches plant uptake over time. Consequently, this significantly decreases nitrate leaching into groundwater and reduces gaseous losses from nitrous oxide emissions and volatilization in cultivated crop fields.

17. (B) Methane
Biogas produced from anaerobic digestion of livestock manure and crop residues consists predominantly of methane, typically comprising fifty to seventy percent of the total volume, alongside carbon dioxide. Methanogenic archaea break down complex organic polymers under oxygen-free conditions, generating combustible methane gas that serves as a clean, renewable energy source for rural cooking and electricity generation.

18. (A) P-2, Q-4, R-1, S-3
Different agricultural activities release distinct gases into the environment. Flooded rice paddies

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floriculture
(D) Promoting the uncalibrated and indiscriminate deployment of heavy farm machinery

66. Under the principles of Integrated Pest Management (IPM), which is the most preferred initial step to control pest populations sustainably?
(A) Conducting routine preventive spraying of broad-spectrum highly toxic chemical insecticides
(B) Completely burning the entire crop field immediately upon the first sighting of any pest
(C) Broadcasting synthetic chemical nematicides continuously across the entire farm surface
(D) Using resistant crop varieties and proper cultural practices

67. Excessive use of which chemical class is most responsible for the decline of beneficial pollinator populations (like honeybees) in agricultural landscapes?
(A) Neonicotinoids
(B) Commercial bio-fungicide formulations
(C) Composted organic livestock manures
(D) Botanical extracts like neem oil solutions

68. Consider the following stages of anaerobic digestion for biogas production from agricultural waste:
I. Methanogenesis
II. Hydrolysis
III. Acetogenesis
IV. Acidogenesis
Which of the following represents the correct sequential order of these stages?
(A) II, IV, III, I
(B) I, II, III, IV
(C) II, III, IV, I
(D) IV, II, I, III

69. 'Agri-silviculture', a prominent form of agroforestry, involves the deliberate combination of:
(A) Agricultural crops and tree species
(B) Agricultural crops integrated with inland fish farming
(C) Tree species combined with pasture for livestock grazing
(D) Pure fruit orchards cultivated without any intercrops

70. In the context of atmospheric pollution, the term "Smog" refers to a mixture of:
(A) Snow and fog
(B) Dust and water vapour
(C) Ozone and mist
(D) Smoke and fog

71. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): The excessive continuous application of solely urea in sugarcane fields can lead to soil acidification over time.
Reason (R): Urea undergoes nitrification in the soil, a process which releases hydrogen ions into the soil solution.
(A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
(B) Both Assertion (A) and Reason (R) are true but R is not the correct explanation of A.
(C) Assertion (A) is true but Reason (R) is false.
(D) Assertion (A) is false but Reason (R) is true.

72. Which of the following is NOT considered a greenhouse gas?
(A) Carbon dioxide gas
(B) Atmospheric methane
(C) Nitrogen gas
(D) Nitrous oxide gas

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73. Which environmental concept focuses on meeting the needs of the present generation without compromising the ability of future generations to meet their own needs?
(A) Maximum Yield Maximization
(B) Extensive Monocropping
(C) Corporate Farming
(D) Sustainable Development

74. Among the given options, which is the most prominent source of ammonia volatilization leading to air pollution in intensive agriculture?
(A) Surface broadcasting of urea
(B) Deep placement of single superphosphate granules
(C) Foliar application of micronutrient liquid sprays
(D) Soil inoculation with biofertilizers like Azotobacter

75. The Central Pollution Control Board (CPCB) of India acts as a statutory organization under which ministry?
(A) Ministry of Agriculture & Farmers Welfare

It enhances cation exchange capacity, improves soil water retention, and promotes beneficial microbial populations in agricultural lands.

28. (B) Red rot
Trichoderma harzianum is a beneficial fungal bio-agent widely used in biological disease management. In sugarcane cultivation, it acts through mycoparasitism, nutrient competition, and antibiosis against Colletotrichum falcatum, the causal organism of red rot disease. Soil application or seed treatment with this antagonist reduces dependence on chemical fungicides, minimizing environmental pesticide residues.

29. (A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
Adopting zero-tillage with surface residue retention substantially decreases the overall carbon footprint of crop cultivation. Eliminating repeated tractor tillage passes significantly reduces agricultural diesel consumption and related greenhouse emissions. Additionally, avoiding soil disturbance minimizes carbon exposure to oxygen, suppressing organic carbon oxidation and favoring long-term carbon sequestration within the soil matrix.

30. (C) Ending hunger, achieving food security, and sustainable agriculture
Sustainable Development Goal 2 aims to end hunger, achieve food security, improve nutrition, and promote sustainable agriculture worldwide by 2030. It focuses on ensuring universal access to safe and nutritious food, doubling smallholder agricultural productivity, implementing resilient agricultural practices, maintaining genetic diversity, and preventing severe land degradation in farming systems globally.

31. (D) High Biological and Chemical Oxygen Demand
Untreated distillery effluent, known as spent wash, contains massive quantities of dissolved organic compounds and dark melanoidin pigments. When discharged into water bodies, its exceptionally high Biological and Chemical Oxygen Demand causes swift depletion of dissolved oxygen through microbial oxidation. This anaerobic transformation kills aquatic life, creates severe odor, and degrades aquatic habitats.

32. (C) Trash mulching between cane rows
Spreading dry sugarcane leaves as trash mulch between crop rows provides an eco-friendly method for weed control in ratoon sugarcane. The physical mulch barrier suppresses weed seed germination by blocking light penetration. Simultaneously, trash mulching conserves soil moisture, regulates soil temperature, builds soil organic matter upon decomposition, and eliminates the need for chemical herbicides.

33. (B) Total greenhouse gases emitted during its production lifecycle
The carbon footprint of an agricultural product quantifies the net greenhouse gas emissions generated across its entire production, processing, transport, and consumption lifecycle. Expressed in carbon dioxide equivalents, it accounts for direct emissions from farm machinery fuel, fertilizer application, and residue burning, alongside indirect emissions from agricultural inputs, enabling precise environmental impact assessments.

34. (B) I, II and III
The PM-KUSUM scheme aims to promote solar energy deployment in the agricultural sector across India. Its core components include supporting individual farmers to install standalone solar water pumps, solarizing existing grid-connected agricultural pumps, and setting up small renewable power plants on barren lands. The scheme intentionally seeks to reduce agricultural dependence on diesel powered irrigation generators.

35. (A) Reduces water consumption and methane emissions
Alternate Wetting and Drying is a water-saving management practice in irrigated paddy systems. Periodically draining fields introduces oxygen into topsoil, disrupting anaerobic conditions necessary for methanogenic archaea activity. Consequently, this water management technique significantly lowers agricultural methane emissions while maintaining crop yields and reducing irrigation water requirements by up to thirty percent.

36. (C) It increases the incidence of severe crop fires
Surface crop residue retention offers key environmental benefits, including moisture conservation, erosion control, and soil organic carbon enhancement. Increased crop fire

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ANSWERS

1. (B) Methane
Submerged paddy fields create an anaerobic environment due to continuous flooding. Methanogenic bacteria break down organic matter in the absence of oxygen, producing methane gas. This gas escapes into the atmosphere through the aerenchyma tissue of rice plants, making flooded rice cultivation a major agricultural source of global atmospheric methane emissions.

2. (D) Nitrates
Contamination of drinking water by nitrate leaching from agricultural fertilizers leads to blue baby syndrome in infants. When ingested, nitrates convert into nitrites, which react with hemoglobin to form methemoglobin. This compound reduces the oxygen-carrying capacity of blood, causing tissue hypoxia and giving skin a bluish hue, particularly in young bottle-fed infants.

3. (A) Surface runoff carrying fertilizers from a catchment area
Non-point source water pollution originates from diffuse, widespread areas rather than a single discrete pipe or outlet. Agricultural surface runoff transports excess synthetic fertilizers, soil sediments, and pesticides across extensive catchment areas during rainfall events. Because the pollutant discharge lacks a specific single point of origin, controlling and monitoring non-point source contamination remains highly challenging for environmental managers.

4. (C) Eutrophication
Excessive phosphorus runoff into freshwater bodies causes eutrophication, characterized by dense growth of algae and aquatic vegetation. Nutrient enrichment triggers rapid algal blooms that block sunlight penetration. Subsequent microbial decomposition of dead algae severely depletes dissolved oxygen levels in water, creating hypoxic dead zones that threaten fish populations and disrupt overall aquatic ecosystem balance.

5. (C) 2010
The National Green Tribunal was established in India under the National Green Tribunal Act 2010 to expedite judicial proceedings concerning environmental protection, forest conservation, and natural resource enforcement. It functions as a specialized judicial body equipped with expertise to resolve complex environmental disputes efficiently while ensuring statutory relief and compensation for victims of environmental pollution.

6. (D) Incorporating the trash into the soil using a rotavator
Incorporating sugarcane trash directly into soil using a rotavator represents an environmentally sound crop residue management technique. Mixing organic residue into the soil enhances microbial activity, increases organic carbon content, and improves soil structure and moisture retention. This method prevents atmospheric air pollution caused by open residue burning while simultaneously returning essential plant nutrients back into the soil matrix.

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7. (B) I and III only
Excessive application of synthetic fertilizers leads to nitrate leaching into groundwater aquifers, causing severe contamination. Furthermore, agricultural runoff loaded with excess nutrients flows into nearby surface water bodies, triggering eutrophication. Over-application actually increases, rather than decreases, soil microbial denitrification and volatilization processes, resulting in elevated emissions of nitrous oxide, a potent greenhouse gas, into the earth's atmosphere.

8. (C) The amount of organic pollution in water
Biological Oxygen Demand measures the quantity of dissolved oxygen required by aerobic microorganisms to break down organic matter present in a water sample over a specified period. High levels indicate elevated amounts of organic pollutants entering aquatic bodies from sewage or agricultural waste, leading to rapid oxygen depletion and severe deterioration of overall water ecosystem health.

9. (D) Climate Action
Sustainable Development Goal 13 focuses on taking urgent action to combat climate change

R. Eutrophication
S. Bioremediation
List II: (Description)
1. Nutrient enrichment of water bodies causing algal blooms
2. Use of microorganisms to degrade environmental pollutants
3. Increasing concentration of toxic substances at successive trophic levels
4. Capture and long-term storage of atmospheric carbon dioxide

(A) P-4, Q-3, R-1, S-2
(B) P-3, Q-4, R-2, S-1
(C) P-4, Q-1, R-3, S-2
(D) P-2, Q-3, R-1, S-4

39. Which biological agent is widely recommended for the control of early shoot borer in sugarcane fields to minimize the use of chemical insecticides?
(A) Rhizobium leguminosarum
(B) Trichogramma chilonis
(C) Azotobacter chroococcum
(D) Pseudomonas fluorescens

40. The 'Soil Health Card' scheme promotes environmental conservation primarily by encouraging farmers to:
(A) Shifting completely to genetically modified crop varieties for higher yields
(B) Substituting all organic manures with concentrated chemical fertilizer mixtures
(C) Applying fertilizers based on soil test recommendations
(D) Discarding traditional seed varieties in favour of imported commercial hybrids

41. In the context of heavy metal pollution in agricultural soils, which of the following practices is most likely to cause Cadmium accumulation?
(A) Regular application of farm-made enriched vermicompost
(B) Foliar application of neem seed kernel extract solutions
(C) Mulching field soils with dry sugarcane trash residue
(D) Continuous use of rock phosphate fertilizers

42. Which among the following is considered an indirect effect of global climate change on agricultural production?
(A) Altered pest and disease dynamics from climate variations
(B) Immediate physical frost damage occurring on standing winter crops
(C) Physical lodging of standing cane caused by sudden localized storms
(D) Mechanical damage caused to root systems during deep tillage operations

43. Which of the following is a primary objective of installing a 'Piezometer' in agricultural watersheds?
(A) To measure the velocity of wind
(B) To monitor groundwater levels and quality
(C) To determine soil temperature at different depths
(D) To measure the intensity of solar radiation

44. What happens when crop residue, particularly sugarcane leaves, is burnt instead of being incorporated into the soil?
(A) The organic carbon content and humic substances of the soil increase significantly
(B) Nitrogen and sulphur are lost to the atmosphere
(C) The population and diversity of beneficial soil microbes thrive rapidly
(D) The water-holding capacity and pore structure of the soil improve permanently

45. Consider the following statements regarding the use of biological pesticides (biopesticides) in agriculture:
I. They generally decompose quickly, resulting in lower environmental residue.
II. They exhibit broad-spectrum toxicity and kill all beneficial insects.
III. Trichoderma viride is widely used as a bio-fungicide for soil-borne diseases.
Which of the above statements is/are correct?
(A) I and II only
(B) I and III only
(C) II and III only
(D) I, II and III

46. The Air Quality Index (AQI) heavily deteriorates in North India during the onset of winter. Which agricultural activity is a major contributor to this seasonal pollution?
(A) Heavy application of urea in wheat fields
(B) Operating combine harvesters during the daytime
(C) Mass burning of paddy stubble in adjacent states
(D) Flooding of fields for the rabi season planting

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foster anaerobic microbes producing methane gas. Synthetic nitrogenous fertilizers release nitrous oxide via soil microbial transformations. Fossil fuel combustion in farm equipment emits carbon dioxide gas. Furthermore, surface application of urea fertilizers leads to ammonia volatilization, contributing to atmospheric secondary aerosol formation.

19. (A) The Insecticides Act, 1968
The Insecticides Act of 1968 regulates the import, manufacturing, sale, transport, distribution, and usage of insecticides across India. Enacted to mitigate health risks to human beings and animals, this statutory framework establishes strict registration procedures, quality standards, and compliance enforcement mechanisms to prevent toxic chemical hazards and environmental contamination resulting from unregulated agrochemical usage.

20. (C) Happy Seeder
The Happy Seeder is an advanced agricultural implement designed for direct sowing of wheat seeds directly into standing paddy stubble without prior field burning. It cuts and lifts the rice straw, sows seeds into the soil, and deposits the cut straw as surface mulch. This technology eliminates air pollution while preserving organic carbon and conserving soil moisture.

21. (A) Puncturing and burying them deep in barren land away from water
Safe disposal of empty pesticide containers requires triple rinsing, puncturing them to prevent reuse, and burying them deep in non-cultivated, barren land away from water sources. Reusing toxic containers for domestic purposes or burning them releases hazardous chemical residues and toxic fumes into the environment, severely risking human health, groundwater safety, and surrounding ecosystem stability.

22. (C) I and III only
Agricultural biodiversity plays a fundamental role in building ecosystem resilience against pest outbreaks, diseases, and climate shocks. Maintaining a diverse pool of crops and wild relatives offers a broader genetic base essential for breeding climate-resilient crop varieties. Conversely, continuous monocropping reduces biodiversity, degrades soil health, and increases vulnerability to biological and environmental hazards.

23. (B) Converting cattle dung and farm waste into biogas and bio-slurry
The Gobardhan Scheme focuses on managing organic waste in rural areas by converting cattle dung, crop residue, and bio-waste into clean biogas and nutrient-rich bio-slurry. This initiative promotes rural sanitation, reduces open dumping, minimizes greenhouse gas emissions, generates clean energy for domestic or commercial usage, and provides organic soil amendments to support sustainable farming.

24. (C) Long-term soil persistence causing biomagnification
Biological pesticides derived from natural materials like plants, bacteria, or minerals are highly target-specific and ecologically safe. Unlike synthetic chemicals, biopesticides break down rapidly in the environment upon exposure to sunlight and microflora. Consequently, they do not persist long-term in soil profiles, nor do they accumulate across food chains or cause toxic biomagnification.

25. (B) Reduce, Reuse, Recycle, Dispose
The standard waste management hierarchy prioritizes waste prevention and minimization at the top. The most preferred action is reducing overall waste generation, followed by reusing suitable materials directly. Recycling processes waste into new usable products, while ultimate disposal in landfills or incinerators represents the least desirable, final option due to potential negative environmental impacts.

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26. (A) Applying inputs like water and fertilizers precisely where needed
Precision agriculture utilizes modern technological tools like GPS, sensors, and spatial data analytics to match agricultural inputs with spatial and temporal field variability. By applying fertilizers, water, and crop protection chemicals in precise quantities exactly where required, precision farming optimizes resource use efficiency, reduces agricultural input waste, and significantly minimizes environmental pollution.

27. (B) Press mud
Press mud, a key solid byproduct from sugar mill juice filtration, serves as an valuable organic soil conditioner. Rich in organic matter, nitrogen, phosphorus, calcium, and trace nutrients, press mud aids in reclaiming sodic and alkaline soils.

57. Bagasse cogeneration in sugar mills directly contributes to environmental conservation by:
(A) Producing highly refined industrial sugar for commercial food processing export
(B) Acting as a potent chemical pesticide to control pests in surrounding crop fields
(C) Increasing the overall biological oxygen demand level of factory wastewater effluents
(D) Generating renewable energy and reducing fossil fuel use

58. Match List I with List II.
List I: (Act/Scheme)
P. Environment (Protection) Act
Q. Water (Prevention and Control of Pollution) Act
R. Air (Prevention and Control of Pollution) Act
S. PM-KUSUM Scheme Launch
List II: (Year of Implementation/Enactment)
1. 1974
2. 1981
3. 1986
4. 2019
(A) P-3, Q-1, R-2, S-4
(B) P-1, Q-3, R-2, S-4
(C) P-3, Q-2, R-1, S-4
(D) P-2, Q-1, R-3, S-4

59. The split application of nitrogenous fertilizers in sugarcane cultivation is an environmentally friendly practice because it primarily:
(A) Completely eliminates the requirement for any manual or chemical weed control measures
(B) Reduces nitrogen losses by matching crop demand
(C) Completely suppresses the growth and incidence of soil-borne fungal crop diseases
(D) Enhances the immediate burning capacity and dryness of sugarcane trash after harvest

60. World Environment Day, utilized widely to promote awareness among farming communities about sustainable practices, is celebrated annually on:
(A) 22nd March
(B) 22nd April
(C) 5th June
(D) 16th September

61. Which biofertilizer is commonly used in paddy fields to fix atmospheric nitrogen and thus reduce the load of synthetic fertilizers causing pollution?
(A) Azolla
(B) Rhizobium
(C) Mycorrhiza
(D) Trichoderma

62. Which of the following is considered a clean and renewable 'Green Energy' source that can be actively harnessed in rural agricultural settings?
(A) Lignite coal
(B) Kerosene
(C) Solar energy
(D) Diesel

63. Consider the following statements regarding press mud, a byproduct of the sugarcane industry:
I. It is rich in organic carbon and essential plant nutrients.
II. Its application in agricultural fields degrades soil structure and causes barrenness.
III. It is frequently used as an organic amendment for soil reclamation.
Which of the above statements is/are correct?
(A) I and II only
(B) II and III only
(C) I and III only
(D) I, II and III

64. Why is the incorporation of farmyard manure (FYM) or compost into soils considered superior to applying only chemical fertilizers for long-term environmental sustainability?
(A) FYM acts as a complete and total direct substitute for all synthetic chemical pesticides
(B) FYM naturally contains a very high concentration of selective synthetic weedicides
(C) FYM improves soil structure and microbial activity
(D) FYM immediately neutralizes strongly acidic and degraded soil profiles overnight

65. The primary objective of conducting environmental awareness training programmes for farmers is to:
(A) Encouraging rural farming families to permanently migrate away from agricultural areas
(B) Equipping them to adopt sustainable agricultural practices
(C) Transitioning traditional crop farmers exclusively to commercial greenhouse

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risk represents a major operational hazard associated with dry residue accumulation rather than a benefit. Proper residue management mitigates fire risks while maximizing soil health, temperature regulation, and weed suppression advantages across fields.

37. (A) Contour bunding
Contour bunding involves constructing small earthen embankments along key elevation contour lines across sloping agricultural lands. These physical barriers slow down surface runoff water velocity, allowing greater infiltration into the soil profile. Consequently, contour bunds effectively minimize soil erosion, trap valuable nutrient-rich sediments, and enhance localized groundwater recharge in rainfed farming watersheds.

38. (A) P-4, Q-3, R-1, S-2
Environmental terms define specific ecological processes. Carbon sequestration involves capturing and storing atmospheric carbon dioxide in long-term sinks like soil or woody biomass. Biomagnification refers to toxic accumulation across food chains. Eutrophication describes surface water nutrient enrichment triggering algal blooms. Bioremediation utilizes living organisms, such as specialized microbes, to break down environmental pollutants.

39. (B) Trichogramma chilonis
Trichogramma chilonis is an egg parasitoid tiny wasp utilized widely as a bio-control agent against sugarcane early shoot borers and pest lepidopterans. The female parasitoid lays its eggs inside pest insect eggs, destroying the host before larvae hatch and bore into crop stems. Inundative releases offer effective pest management without requiring hazardous chemical sprays.

40. (C) Applying fertilizers based on soil test recommendations
The Soil Health Card scheme promotes sustainable nutrient management by providing farmers with crop-wise nutrient recommendations based on comprehensive soil testing. By encouraging targeted fertilizer application tailored to actual soil deficiency profiles, the initiative prevents imbalanced chemical fertilizer overuse, lowers cultivation costs, preserves long-term soil fertility, and minimizes agricultural runoff and groundwater contamination.

41. (D) Continuous use of rock phosphate fertilizers
Continuous application of rock phosphate fertilizers serves as a significant source of cadmium accumulation in agricultural soils. Sedimentary rock phosphate deposits naturally contain varying concentrations of heavy metals, including cadmium. Repeated long-term soil applications lead to toxic element build-up, increasing heavy metal uptake by food crops and presenting long-term health risks to consumers.

42. (A) Altered pest and disease dynamics from climate variations
Global climate change exerts indirect systemic effects on agricultural systems by altering pest and disease dynamics. Shifts in temperature regimes, ambient humidity, and rainfall patterns influence pest geographical distribution, rate of reproduction, overwintering survival, and host-pathogen interactions. Consequently, crop plants face altered pest pressures, creating unpredictable protection challenges across different regional cropping environments.

43. (B) To monitor groundwater levels and quality
A piezometer is a specialized non-pumping observation tube or well installed in agricultural watersheds to measure pore-water pressure and depth to piezometric surfaces. Monitoring water table fluctuations, hydraulic gradients, and sampling subsurface water quality via piezometers provides critical hydrogeological data necessary for sustainable groundwater management, waterlogging control, and salinization prevention.

44. (B) Nitrogen and sulphur are lost to the atmosphere
Burning crop residues causes high-temperature combustion that rapidly volatilizes structural organic elements. Essential plant nutrients, particularly nitrogen and sulphur, convert into gaseous nitrogen oxides and sulphur dioxide during combustion, escaping completely into the atmosphere. This combustion destroys valuable organic carbon, kills beneficial topsoil microflora, and severely degrades physical soil health and water-holding capacity.

45. (B) I and III only
Biopesticides break down rapidly in the environment under natural solar and biological action, avoiding hazardous residue accumulation. Unlike broad-spectrum synthetic chemicals, they

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(D) Recognized needs - Needs identified jointly through collaborative dialogue between extension workers and the community

35. Arrange the following historical rural development projects in India in their correct chronological order of establishment:
I. Etawah Pilot Project
II. Community Development Programme (CDP)
III. Gurgaon Project
IV. Sriniketan Project
Which of the following is the correct chronological order?
(A) IV, III, I, II
(B) III, IV, II, I
(C) IV, I, III, II
(D) I, II, III, IV

36. The 'Gurgaon Project', an early attempt at rural upliftment focusing on agriculture and sanitation, was initiated in 1920 by:
(A) F.L. Brayne
(B) Mahatma Gandhi
(C) Rabindranath Tagore
(D) Daniel Hamilton

37. On which historical date was the Community Development Programme (CDP) launched in India?
(A) 26th January 1950
(B) 15th August 1947
(C) 2nd October 1952
(D) 2nd October 1959

38. Match the pre-independence rural reconstruction experiments in List I with their key founders in List II.
List I: (Rural Reconstruction Experiment)
P. Marthandam Project
Q. Sriniketan Project
R. Sewagram Project
S. Firka Development Scheme
List II: (Key Founder)
1. T. Prakasam
2. Mahatma Gandhi
3. Rabindranath Tagore
4. Spencer Hatch
(A) P-4, Q-3, R-2, S-1
(B) P-3, Q-4, R-1, S-2
(C) P-4, Q-2, R-3, S-1
(D) P-1, Q-3, R-2, S-4

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39. At the national level in India, which apex body is responsible for coordinating, guiding, and managing agricultural research and extension education?
(A) NITI Aayog (National Institution for Transforming India)
(B) Ministry of Rural Development, Government of India
(C) Food Corporation of India (FCI Procurement Wing)
(D) Indian Council of Agricultural Research (ICAR)

40. In the organizational structure of State Agricultural Universities (SAUs) in Uttar Pradesh, who heads the extension activities for taking technologies to the farmers?
(A) Office of the Vice-Chancellor
(B) Director of Extension Education
(C) Dean of the Faculty of Agriculture
(D) University Administrative Registrar

41. Consider the following statements about the organizational structure of agricultural extension in India:
I. The Directorate of Extension (DoE) at the central level functions under the Ministry of Agriculture & Farmers Welfare.
II. State Departments of Agriculture are primarily responsible for input supply and grassroots extension delivery.
III. Non-Governmental Organizations (NGOs) are strictly prohibited from undertaking agricultural extension work in India.
Which combination of the above statements is correct?
(A) I and II only
(B) II and III only
(C) I and III only
(D) I, II and III

42. In which year and location was the first Krishi Vigyan Kendra (KVK) established in India?
(A) 1960 at Pantnagar (Uttarakhand)
(B) 1982 at Kanpur (Uttar Pradesh)
(C) 1990 at New Delhi (Union Territory)
(D) 1974 at Pondicherry (Puducherry)

43. The establishment of Krishi Vigyan Kendras (KVKs) across India was recommended by which of the following committees?
(A) Dr. Mohan Singh Mehta Committee
(B) Balwant Rai Mehta Study Committee
(C) Ashok Mehta Committee on Panchayati Raj

54. (D) Rodenticide - Insect larvae
Agrochemical classifications correspond directly to their intended pest target species. Herbicides target unwanted weed species, nematicides control plant-parasitic roundworms, and fungicides eliminate destructive fungal pathogens. Conversely, rodenticides are formulated specifically to control rodent pests like rats and mice, whereas insect larvae are targeted using larvicides or insecticides rather than rodenticides.

55. (B) Complete burning of crop residues to sanitize the field
Conservation Agriculture relies on three interrelated core principles: minimal mechanical soil disturbance through zero tillage, maintaining a permanent protective soil cover using crop residues or cover crops, and diversifying crop species in rotations or associations. Complete burning of crop residues contradicts these principles by exposing bare soil to erosion and degrading soil organic carbon.

56. (C) I, II and III
Established in 2010 under the NGT Act, the National Green Tribunal handles civil legal cases concerning environmental conservation, forest protection, and natural resource enforcement. The tribunal awards binding decisions, relief, and compensation for environmental damage to affected persons. Unlike mere advisory bodies, NGT orders carry statutory judicial authority enforceable across all states.

57. (D) Generating renewable energy and reducing fossil fuel use
Bagasse cogeneration utilizes dry fibrous sugarcane residue left after juice extraction to generate high-pressure steam and electricity in sugar mill boilers. By burning biomass waste to power mill operations and export surplus electricity to the power grid, cogeneration displaces fossil fuel reliance, reduces coal-fired power emissions, and promotes clean renewable energy production.

58. (A) P-3, Q-1, R-2, S-4
Key environmental acts and schemes in India were instituted in specific years. The Water (Prevention and Control of Pollution) Act was enacted in 1974, followed by the Air (Prevention and Control of Pollution) Act in 1981. The umbrella Environment (Protection) Act was passed in 1986, while the PM-KUSUM solar agricultural initiative was launched in 2019.

59. (B) Reduces nitrogen losses by matching crop demand
Applying nitrogenous fertilizers in multiple split doses throughout the sugarcane growing season aligns nutrient availability with crop uptake patterns. Supplying nitrogen in synchronized quantities prevents soil nitrogen saturation, thereby reducing environmental losses from ammonia volatilization, nitrate leaching into aquifers, and gaseous nitrous oxide emissions, ultimately improving nutrient utilization efficiency in soil profiles.

60. (C) 5th June
World Environment Day is celebrated globally on June 5th every year under the leadership of the United Nations Environment Programme. It provides an international platform to raise public awareness, promote policy reforms, and encourage sustainable environmental practices, including eco-friendly farming methods, soil conservation, biodiversity protection, and sustainable natural resource management globally.

61. (A) Azolla
Azolla is a free-floating freshwater aquatic fern that forms a symbiotic association with the nitrogen-fixing cyanobacterium Anabaena azollae. In flooded paddy fields, Azolla fixes atmospheric nitrogen efficiently and serves as a green manure. Incorporating Azolla enriches soil nitrogen content, enhances organic matter, and significantly reduces reliance on synthetic chemical nitrogenous fertilizers.

62. (C) Solar energy
Solar energy is a clean, abundant, and renewable energy source derived from sunlight. In rural agricultural settings, solar technology powers irrigation pumps, crop dryers, cold storage facilities, and lighting systems without emitting greenhouse gases or air pollutants. Adopting solar power displaces fossil fuel usage, reduces operational farming expenditures, and promotes eco-friendly agricultural operations.

63. (C) I and III only
Press mud is a nutrient-dense sugar industry byproduct high in organic carbon, nitrogen, phosphorus, and essential micronutrients. Applying press mud improves soil physical

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(D) Assertion (A) is false but Reason (R) is true.

16. In the process of taking agricultural technology from the research station to the farmer's field, the extension system functions as a:
(A) Regulatory authority
(B) Financial lending institution
(C) Marketing agency
(D) Two-way communication bridge

17. If an extension worker notices a severe outbreak of red rot in a specific sugarcane variety in UP and reports it back to the Sugarcane Research Institute for a solution, this demonstrates:
(A) The top-down administrative approach
(B) The principle of cultural difference
(C) The feedback mechanism in extension
(D) The failure of the extension worker

18. Which of the following is an INCORRECT statement regarding the role of agricultural extension?
(A) It helps farmers make their own decisions by providing options and knowledge.
(B) It involves dictating and forcing farmers to adopt a specific crop variety.
(C) It aims at capacity building and skill enhancement of the farming community.
(D) It acts as a link between research institutions and the farming community.

19. What is the correct chronological sequence of the steps in the Extension Education Process?
(A) Situation → Objectives → Teaching → Evaluation → Reconsideration
(B) Objectives → Situation → Evaluation → Teaching → Reconsideration
(C) Situation → Teaching → Objectives → Reconsideration → Evaluation
(D) Evaluation → Situation → Objectives → Teaching → Reconsideration

20. In the extension education process, setting up a demonstration on a farmer's field to show the trench method of sugarcane planting falls under which step?
(A) Teaching and Action
(B) Analysis of the Situation
(C) Determination of Objectives
(D) Evaluation

21. Which step of the extension process involves determining the extent to which the preset objectives have been achieved?
(A) Situation analysis
(B) Objective formulation
(C) Evaluation
(D) Reconsideration

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22. In Uttar Pradesh, the 'Etawah Pilot Project'—a landmark in the history of Indian agricultural extension—was launched in 1948 by:
(A) Albert Mayer
(B) F.L. Brayne
(C) Spencer Hatch
(D) S.K. Dey

23. What is the primary role of a Gram Panchayat Adhikari or an agriculture-department extension worker at the village level?
(A) To function strictly as a land revenue collector responsible for enforcing rural taxation on farmers
(B) To serve as the official village magistrate with complete authority to resolve civil and legal land disputes
(C) To manage administrative operations and conduct daily teaching duties in the local primary school
(D) To act as a multi-purpose village worker bridging government schemes and rural households

24. Match the extension communication methods in List I with their examples in List II.
List I: (Extension Communication Method)
P. Individual Contact
Q. Group Contact
R. Mass Contact
S. Traditional Media
List II: (Example)
1. Kisan Mela (Farmer Fair)
2. Farm and Home Visit
3. Puppet Show
4. Method Demonstration
(A) P-2, Q-4, R-1, S-3
(B) P-4, Q-2, R-1, S-3
(C) P-2, Q-1, R-4, S-3
(D) P-1, Q-2, R-3, S-4

25. The core philosophical foundation of agricultural extension education is based on the premise of:
(A) "Doing everything for the farmers"
(B) "Enforcing strict government agricultural rules"
(C) "Helping people to help themselves"
(D) "Providing permanent free subsidies"

thermal radiation. In contrast, greenhouse gases like carbon dioxide, methane, and nitrous oxide absorb terrestrial heat, trapping infrared energy within the atmosphere and contributing directly to global climate warming dynamics.

73. (D) Sustainable Development
Sustainable development emphasizes managing resources to fulfill present human socio-economic needs without compromising the capacity of future generations to satisfy their own needs. In agriculture, sustainable practices balance crop productivity, economic viability, and natural resource conservation, safeguarding soil health, water resources, and ecosystem integrity while ensuring long-term food security across global agricultural landscapes.

74. (A) Surface broadcasting of urea
Surface broadcasting of urea without soil incorporation leads to high rates of ammonia volatilization. When urea hydrolyzes at the soil surface into ammonium carbonate, high soil pH and ambient temperatures promote the conversion of ammonium into gaseous ammonia. This ammonia escapes readily into the atmosphere, causing air pollution and reducing overall nitrogen use efficiency.

75. (B) Ministry of Environment, Forest and Climate Change
The Central Pollution Control Board is a statutory organization established in 1974 under the Water (Prevention and Control of Pollution) Act. Operating under the administrative control of the Ministry of Environment, Forest and Climate Change, CPCB plans nationwide pollution prevention programs, coordinates state pollution control activities, and establishes environmental quality standards across India.

76. (A) P-2, Q-4, R-1, S-3
Biological pest control uses natural enemy organisms against agricultural targets. Trichogramma chilonis parasitizes sugarcane borer eggs. Bacillus thuringiensis produces crystal proteins that target lepidopteran caterpillars upon ingestion. Trichoderma harzianum acts as a bio-fungicide against soil-borne root rot and wilt pathogens. Nuclear Polyhedrosis Virus functions as a host-specific viral pathogen suppressing Helicoverpa armigera populations.

77. (A) A village using integrated practices to reduce climate risks and emissions
A Climate-Smart Village integrates community-tailored sustainable agricultural practices to address climate variability and lower greenhouse gas emissions. Combining various climate-smart technologies—such as localized weather forecasting, direct seeding, rainwater harvesting, and organic nutrient management—these villages build agricultural resilience, improve rural livelihoods, and enhance food security while safeguarding natural resources.

78. (C) Elevated temperatures increase crop evapotranspiration and irrigation demand
Rising atmospheric temperatures driven by global climate change elevate land evaporation and crop transpiration rates. Accelerated evapotranspiration increases soil moisture depletion, forcing crop plants to consume water more rapidly. Consequently, elevated temperature regimes expand seasonal agricultural crop water requirements, heightening irrigation demand and exacerbating regional freshwater scarcity challenges across cultivated landscapes.

79. (D) Managing residue within the field by incorporation or surface retention
In-situ crop residue management involves handling harvest stubble directly inside the field where it grew, rather than removing or burning it. Methods include surface retention as protective mulch or soil incorporation using specialized implements like rotavators or Happy Seeders. In-situ practices preserve organic carbon, improve soil structure, and prevent open atmospheric residue burning.

80. (C) Integrating leguminous cover crops and adopting zero tillage
Combining leguminous cover crops with zero tillage practices offers a direct method to reduce farm carbon footprints. Zero tillage suppresses soil organic carbon oxidation and lowers tractor fuel consumption. Meanwhile, leguminous cover crops naturally fix atmospheric nitrogen, decreasing synthetic chemical fertilizer reliance, while building permanent soil organic matter and enhancing long-term soil carbon sequestration.

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CHAPTER 19

Principles of Agricultural Extension and Rural Development

1. The word 'Extension' is derived from which language roots?
(A) Greek words 'ex' meaning 'out' and 'tensio' meaning 'stretching'
(B) French words 'ex' meaning 'out' and 'tensio' meaning 'stretching'
(C) Latin words 'ex' meaning 'out' and 'tensio' meaning 'stretching'
(D) Roman words 'ex' meaning 'out' and 'tensio' meaning 'stretching'

2. Agricultural extension is primarily considered what type of education system?
(A) Formal and strictly curriculum-based classroom instruction
(B) Non-formal, out-of-school education for behavioral change
(C) Informal and completely unstructured experiential learning
(D) Purely theoretical, institutional, and academic training

3. What is the fundamental objective of agricultural extension at the village level?
(A) To maximize the overall annual revenue generated by the government
(B) To enforce strict state agricultural laws and penalize defaulters
(C) To distribute free agricultural inputs and machinery to villagers
(D) To bring about desirable changes in the human behavior of farmers

4. The 'Principle of Participation' in agricultural extension implies that:
(A) Extension programmes must be planned and executed with the active involvement of the local people
(B) Extension programmes should be planned and executed exclusively with wealthy progressive farmers
(C) Extension programmes require government administrative officials to participate directly in farming
(D) Extension programmes require farmers to participate in local political elections to receive benefits

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5. If an extension worker starts a programme based on the current knowledge and resources of the sugarcane farmers, which principle of extension is being followed?
(A) Principle of Cultural Difference
(B) Principle of Evaluation
(C) Principle of Grass-roots approach
(D) Principle of Family approach

6. Consider the following statements regarding the basic principles of agricultural extension:
I. The principle of trust requires building mutual confidence between the extension worker and the farmer.
II. The principle of continuity implies that extension is a one-time process ending with a single crop harvest.
III. The principle of adaptability ensures that extension programmes can be adjusted to changing local conditions.
Which combination of the above statements is correct?
(A) I and II only
(B) II and III only
(C) I and III only
(D) I, II and III

7. Human behavior change through extension occurs in three domains. Which of the following correctly represents these domains?
(A) Physical, Financial, and Political
(B) Traditional, Modern, and Post-modern
(C) Planning, Execution, and Evaluation
(D) Cognitive, Affective, and Psychomotor

8. When a cane supervisor teaches a farmer the precise technique of cutting three-bud setts and treating them with fungicides, this primarily targets which domain of learning?
(A) Cognitive domain (Knowledge)

(B) Psychomotor domain (Skill)
(C) Affective domain (Attitude)
(D) Spiritual domain (Belief)

9. What is the ultimate conceptual goal of rural development?
(A) Urbanization and industrial transformation of all traditional rural villages
(B) Complete mechanization and technological modernization of all agricultural lands
(C) Overall qualitative and quantitative improvement in the living standards of rural people
(D) Shifting all rural agricultural labor permanently to the urban industrial sector

10. Which of the following is NOT typically considered a dimension of comprehensive rural development?
(A) Economic development (income generation and financial growth)
(B) Social development (health, education, and social welfare)
(C) Infrastructure development (rural roads, transport, and electricity)
(D) Space exploration development (satellite launching capabilities)

11. What is the fundamental difference between 'Growth' and 'Development' in the context of rural areas?
(A) Growth refers to an increase in physical output or income, whereas development includes growth along with positive social and structural changes
(B) Growth refers to qualitative improvements in social well-being, whereas development is strictly confined to quantitative economic expansion
(C) Growth is a long-term continuous structural transformation process, whereas development is an instantaneous short-term economic fluctuation
(D) Growth and development share an identical conceptual framework, meaning there is no practical or theoretical distinction between them

12. In Uttar Pradesh, the 'Integrated Rural Development Programme' (IRDP) was originally initiated with the primary objective of:
(A) Providing subsidized irrigation infrastructure and water resources directly to large agricultural landlords
(B) Eradicating rural poverty by providing income-generating assets to the poorest of the poor
(C) Establishing state-funded large-scale sugarcane processing mills in every administrative district
(D) Providing modern free mobile electronic communication devices directly to unemployed rural youth

13. A 'Bottom-up approach' in rural development planning means:
(A) Directives are issued by the Central Government and followed strictly at the village level
(B) Planning starts at the grassroots or village level and moves upwards to higher administrative levels
(C) Financial allocation and project funding are approved only after all field implementation work is completed
(D) Farming activities and agricultural subsidies are restricted exclusively to the poorest members of the village

14. Which of the following best describes the interrelationship between agricultural extension and rural development?
(A) Agricultural extension acts as a critical educational vehicle to achieve the broader goals of rural development
(B) Agricultural extension operates completely independently of and without any functional link to rural development
(C) Rural development serves merely as a specialized technical subset within the broader scope of agricultural extension
(D) Agricultural extension is strictly concerned with crop yields, having no structural impact on overall rural life

15. Read the given Assertion (A) and Reason (R) carefully.
Assertion (A): Agricultural extension plays a symbiotic role in rural development.
Reason (R): Improved agricultural productivity through extension directly leads to better rural incomes and capital formation for local infrastructure.
(A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
(B) Both Assertion (A) and Reason (R) are true but R is not the correct explanation of A.
(C) Assertion (A) is true but Reason (R) is false.

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display high target specificity without harming non-target organisms or natural predators. Fungal agents like Trichoderma viride serve as highly effective bio-fungicides against destructive soil-borne fungal pathogens causing root rots and wilts.

46. (C) Mass burning of paddy stubble in adjacent states
Widespread seasonal paddy stubble burning in northern India during autumn releases massive plumes of smoke containing particulate matter, carbon monoxide, and volatile organic compounds. Driven by prevailing winter winds and thermal inversion layers, these emissions accumulate in the lower atmosphere, causing severe smog formation and major spikes in Air Quality Index levels across North India.

47. (D) Drip irrigation
Drip irrigation delivers water directly to crop root zones slowly through low-pressure emitter networks, achieving water use efficiencies exceeding ninety percent. By minimizing surface evaporation, deep percolation, and weed uptake, drip systems conserve limited freshwater reserves. This controlled localized application prevents groundwater depletion while preventing soil erosion and nutrient leaching compared to conventional surface flooding.

48. (A) Carbon dioxide, Methane, Nitrous oxide
Global Warming Potential measures heat-trapping capacity relative to carbon dioxide over a century. Carbon dioxide serves as baseline with a value of one. Methane possesses approximately twenty-eight times higher warming potential than carbon dioxide. Nitrous oxide displays an even greater impact, absorbing nearly three hundred times more atmospheric heat than carbon dioxide over the same timeframe.

49. (B) Silicon and trace elements
Fly ash generated from thermal power plants contains substantial amounts of soluble silicon, calcium, magnesium, and essential trace elements. Applied in controlled low doses, it enhances physical soil properties, improves water retention, neutralizes acidic soil conditions, and provides silicon that strengthens crop cell walls, making plants more resilient against environmental stresses and fungal pathogens.

50. (D) In-situ and ex-situ management practices for crop residues
The National Policy for Management of Crop Residues promotes a balanced mix of in-situ and ex-situ conservation measures. In-situ strategies focus on residue mulching, incorporation, and direct seeding using specialized machinery. Ex-situ approaches encourage collecting stubble for bio-energy production, industrial power generation, composting, and paper manufacturing, preventing ambient air pollution caused by burning.

51. (A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
Incorporating leguminous crops into rotation cycles significantly lowers the agricultural carbon footprint. Symbiotic Rhizobium bacteria in legume root nodules fix atmospheric nitrogen directly into plant-available forms. This natural biological nitrogen fixation reduces reliance on energy-intensive synthetic chemical fertilizers, thereby lowering fossil fuel energy expenditure during fertilizer manufacturing and decreasing nitrous oxide greenhouse gas emissions.

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52. (C) Utilizing earthworms and microbes to degrade soil pollutants
Vermoremediation is an eco-friendly soil remediation technique that combines earthworms and associated soil microorganisms to detoxify contaminated environments. Earthworms ingest polluted soil, breaking down complex organic contaminants through intestinal digestive enzymes and symbiotic gut microbes. This biological process accelerates pollutant degradation, improves soil aeration, builds humic matter, and enhances overall soil biological activity safely.

53. (A) Methyl bromide
Methyl bromide is an effective broad-spectrum halogenated chemical soil fumigant used historically for controlling nematodes, weeds, and soil pathogens. However, when released into the atmosphere, solar ultraviolet radiation breaks down methyl bromide, liberating bromine radicals that destroy stratospheric ozone layer molecules. Consequently, international environmental agreements like the Montreal Protocol mandated its global phase-out.

26. Which of the following is NOT a recognized value of the extension education philosophy?
(A) Belief in democratic principles
(B) Respect for the individual farmer's intelligence
(C) Reliance on science and factual information
(D) Coercion and mandatory compliance

27. Consider the following statements regarding the philosophical principles of extension:
I. Extension promotes paternalism rather than self-reliance.
II. Extension philosophy is based on pragmatism, meaning learning by doing.
III. Extension recognizes the home and family as the fundamental unit of development.
IV. Extension believes in continuous education for all age groups.
Which combination of the above statements is correct?
(A) I, II and III
(B) II, III and IV
(C) I, III and IV
(D) I, II, III and IV

28. Participatory Rural Appraisal (PRA) as an extension methodology was heavily promoted and popularized by:
(A) M.S. Swaminathan
(B) Robert Chambers
(C) Norman Borlaug
(D) J.P. Leagans

29. In the context of PRA techniques, what does a 'Transect Walk' refer to?
(A) A comprehensive financial audit and accounting review of the local primary village cooperative society
(B) A systematic walk with local people through the village to observe and discuss spatial distribution of resources
(C) A village-wide political rally organized by the extension worker to promote government developmental policies
(D) A theoretical mapping exercise conducted remotely in an administrative office using advanced satellite imagery

30. If an extension team wants to document the historical outbreak patterns of pyrilla pest in a sugarcane belt over the last 50 years based on farmers' memory, which PRA tool is most appropriate?
(A) Timeline / Historical Profile
(B) Venn Diagram / Institutional Map
(C) Seasonal Calendar / Crop Matrix
(D) Resource Map / Spatial Analysis

31. Match the PRA tools in List I with their primary purposes in List II.
List I: (PRA Tool)
P. Seasonal Calendar
Q. Venn Diagram
R. Wealth Ranking
S. Resource Map
List II: (Primary Purpose)
1. Identifying institutional relationships and importance
2. Understanding socio-economic disparities in the village
3. Documenting monthly variations in rainfall, labour, and crop activities
4. Identifying natural and physical assets like land, water, and forests
(A) P-3, Q-1, R-2, S-4
(B) P-1, Q-3, R-4, S-2
(C) P-3, Q-2, R-1, S-4
(D) P-4, Q-1, R-2, S-3

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32. The concept of 'Community Development' essentially requires the mobilization of both:
(A) Foreign financial aid and imported urban industrial labour
(B) Private industrial capital and corporate agribusiness management
(C) Multi-national agricultural corporations and global import markets
(D) Government machinery and local human/ natural resources

33. The success of any community-based development programme is highest when it is primarily based on the community's:
(A) Unfelt needs
(B) Imposed needs by the government
(C) Felt needs
(D) Fictional needs

34. Which of the following pairs concerning community development needs is INCORRECTLY matched?
(A) Felt needs - Needs recognized, prioritized, and explicitly desired by the local people themselves
(B) Imposed needs - Needs generated organically by the farmers without external influence
(C) Unfelt needs - Real needs that physically exist in the community but people are not yet aware of them

properties, enhances cation exchange, and stimulates microflora activity. It serves as an effective organic soil conditioner for reclaiming degraded or alkaline agricultural soils without damaging overall soil fertility or causing permanent land barrenness.

64. (C) FYM improves soil structure and microbial activity
Farmyard manure provides organic matter that binds soil particles into stable aggregates, improving soil porosity, water infiltration, and moisture retention. Unlike synthetic fertilizers that supply isolated chemical nutrients, FYM stimulates soil biological activity, feeds beneficial soil microbes, enhances cation exchange capacity, and maintains long-term soil structure and fertility essential for sustainable agricultural ecosystems.

65. (B) Equipping them to adopt sustainable agricultural practices
Environmental awareness training programmes aim to educate farming communities on sustainable natural resource management. These educational initiatives equip farmers with knowledge regarding balanced fertilizer usage, integrated pest management, soil conservation, residue management, and climate-smart technologies. Consequently, training empowers rural populations to protect regional ecosystems, optimize input efficiency, and enhance long-term farm profitability sustainably.

66. (D) Using resistant crop varieties and proper cultural practices
Integrated Pest Management prioritizes preventive, non-chemical control strategies as the first line of defense against crop pests. Utilizing pest-resistant crop cultivars alongside proper cultural practices—such as crop rotation, balanced fertilization, optimal planting dates, and crop hygiene—suppresses pest populations naturally while conserving beneficial predatory organisms and minimizing dependence on synthetic chemical interventions.

67. (A) Neonicotinoids
Neonicotinoids represent a class of neuro-active systemic insecticides widely applied in crop protection. Because they translocate throughout plant tissues, neonicotinoid residues accumulate in nectar and pollen. Ingestion or exposure impairs foraging behavior, navigation, memory, and reproductive success in beneficial pollinators like honeybees, causing widespread colony collapse and significant pollinator population declines.

68. (A) II, IV, III, I
Anaerobic digestion converts organic biomass into biogas through four consecutive biological stages. Hydrolysis first breaks down complex organic polymers into simple monomers. Acidogenesis then converts these monomers into volatile fatty acids. Next, acetogenesis transforms fatty acids into acetic acid, hydrogen, and carbon dioxide. Finally, methanogenesis utilizes these compounds to produce methane gas.

69. (A) Agricultural crops and tree species
Agri-silviculture is an agroforestry system that combines the deliberate cultivation of agricultural crops with tree species on the same piece of land. The woody perennials provide shade, windbreaks, timber, and soil stabilization, while the intercropped agricultural plants produce seasonal food or fodder yields. This integrated system enhances land productivity, soil organic carbon, and farm income.

70. (D) Smoke and fog
Smog is a severe atmospheric pollutant mixture formed by the combination of smoke particles and natural fog in atmospheric air. In industrial and agricultural areas, smoke containing fine particulate matter, soot, and chemical gases reacts with atmospheric water droplets, forming a thick haze that restricts visibility, damages plant tissues, and induces respiratory illnesses.

71. (A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
Continuous heavy application of urea can cause soil acidification over time. In soil, applied urea hydrolyzes into ammonium ions, which undergo nitrification by autotrophic bacteria to form nitrate. This biological transformation releases hydrogen ions into the soil solution. Accumulation of hydrogen ions increases soil acidity, lowering soil pH and negatively affecting nutrient availability.

72. (C) Nitrogen gas
Atmospheric nitrogen gas comprises approximately seventy-eight percent of Earth's atmosphere and is a diatomically stable, non-greenhouse gas that does not absorb infrared

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(D) M.S. Swaminathan Farmers Committee

44. Consider the following activities regarding the mandate of a Krishi Vigyan Kendra (KVK):
I. Conducting On-Farm Testing (OFT) to identify location-specific technologies.
II. Organizing Frontline Demonstrations (FLD) to establish production potential of technologies.
III. Enacting and enforcing state agricultural marketing laws.
IV. Providing capacity development training to farmers and extension personnel.
Which combination of the above statements correctly represents the core mandate of a KVK?
(A) I, II and III
(B) I, II and IV
(C) II, III and IV
(D) I, III and IV

45. The Krishi Vigyan Kendras (KVKs) in Uttar Pradesh are financially supported up to 100% by which organization?
(A) World Bank Agricultural Development Fund
(B) Indian Council of Agricultural Research (ICAR)
(C) State Department of Agriculture, Uttar Pradesh
(D) National Bank for Agriculture and Rural Development (NABARD)

46. What is the full form of ATMA, an important scheme implemented at the district level for agricultural extension?
(A) Agricultural Technology Management Agency
(B) Agricultural Trade and Marketing Association
(C) Advanced Tractors and Machinery Agency
(D) Agronomy Training and Management Authority

47. At the district level, the Governing Board of ATMA is chaired by the:
(A) Chief District Agriculture Officer (CDO/ DAO)
(B) Chief District Development Officer (CDO)
(C) District Magistrate (DM) / Collector
(D) Local Area Member of Parliament (MP)

48. Under the ATMA organizational structure, the core committee responsible for preparing the Block Action Plan and operating at the block level is called:
(A) State Extension Education Committee (SEEC)
(B) District Farmers Advisory Committee (DFAC)
(C) Village Panchayat Board (VPB)
(D) Block Technology Team (BTT)

49. Read the given Assertion (A) and Reason (R) carefully.
Assertion (A): The ATMA model of agricultural extension represents a shift from a top-down approach to a bottom-up approach.
Reason (R): ATMA mandates the preparation of Strategic Research and Extension Plans (SREP) starting from the village and block levels involving farmer inputs.
(A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
(B) Both Assertion (A) and Reason (R) are true but R is not the correct explanation of A.
(C) Assertion (A) is true but Reason (R) is false.
(D) Assertion (A) is false but Reason (R) is true.

50. What is the correct all-India toll-free number for the Kisan Call Centre (KCC), which provides agricultural advisory to farmers?
(A) 1800-180-1155
(B) 1800-180-1551
(C) 1800-180-1515
(D) 1800-180-5151

51. The government portal 'AGMARKNET' primarily provides farmers with information regarding:
(A) District-level weather forecasting, climate warnings, and rainfall probability
(B) Financial subsidies and loan schemes available for purchasing farm tractors
(C) Regional soil testing laboratory locations and soil health card services
(D) Daily agricultural commodity prices and market arrivals in APMC mandis

52. Which of the following is the odd one out in the context of modern ICT tools used in agricultural extension?
(A) Persian Wheel (Rahat)
(B) Mobile Kisan Suvidha App
(C) National mKisan SMS Portal
(D) Electronic National Agriculture Market (e-NAM)

53. Consider the following digital initiatives in Indian agriculture:

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(D) Formative evaluation

72. Which of the following pairs concerning programme assessment is INCORRECTLY matched?
(A) Monitoring - Continuous tracking of programme inputs and activities
(B) Formative Evaluation - Done after the programme has completely ended
(C) Evaluation - Periodic assessment of programme impact and goal achievement
(D) Summative Evaluation - Done at the conclusion of the programme

73. What is the most important reason for maintaining a robust system of feedback in agricultural extension?
(A) It provides administrative data to legally penalize and punish underperforming farmers
(B) It systematically delays and postpones the actual field execution of the agricultural plan
(C) It helps research scientists modify technologies based on actual field constraints faced by farmers
(D) It serves as a compulsory legal requirement to calculate and charge agricultural taxes from farmers

74. The concept of 'Sustainable Rural Development' prioritizes which of the following approaches?
(A) Indiscriminate and continuous application of synthetic chemical fertilizers to maximize short-term crop yields
(B) Rapid and complete extraction of underground water resources to accelerate immediate industrial growth
(C) Banning all traditional and modern agricultural farming activities across rural communities completely
(D) Meeting the needs of the present generation without compromising the ability of future generations to meet their own needs

75. The term 'Evergreen Revolution', highlighting the need to enhance agricultural productivity in perpetuity without associated ecological harm, was coined by:
(A) M.S. Swaminathan
(B) Verghese Kurien
(C) Norman Borlaug
(D) R.S. Paroda

76. Consider the following strategies regarding sustainable rural development:
I. Promotion of integrated pest management (IPM) in sugarcane to reduce pesticide load.
II. Encouraging mono-cropping of highly exhausting crops without crop rotation.
III. Enhancing water use efficiency through drip irrigation and trench planting.
Which combination of the above statements represents sustainable strategies?
(A) I and II only
(B) II and III only
(C) I and III only
(D) I, II and III

77. Which Constitutional Amendment Act formalized the Panchayati Raj Institutions (PRIs) to ensure local self-governance and participation in rural development?
(A) 72nd Amendment Act, 1992
(B) 73rd Amendment Act, 1992
(C) 74th Amendment Act, 1992
(D) 86th Amendment Act, 2002

78. The three-tier structure of the Panchayati Raj System in India was fundamentally recommended by the:
(A) Balwant Rai Mehta Committee
(B) Sarkaria Central Commission
(C) Kothari Education Commission
(D) Mandal Backward Classes Commission

79. Read the given Assertion (A) and Reason (R) carefully.
Assertion (A): The 73rd Constitutional Amendment Act empowered Gram Panchayats to prepare plans for economic development and social justice.
Reason (R): Decentralized planning ensures that rural development programmes are directly aligned with local needs and local resource availability.
(A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
(B) Both Assertion (A) and Reason (R) are true but R is not the correct explanation of A.
(C) Assertion (A) is true but Reason (R) is false.
(D) Assertion (A) is false but Reason (R) is true.

80. In the three-tier Panchayati Raj system of Uttar Pradesh, the intermediate tier that corresponds to the Development Block level is known as:
(A) Gram Panchayat
(B) Zila Parishad

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(D) I, II and III

63. Under government schemes promoting FPOs, what is the purpose of the 'Equity Grant' provided to a Farmer Producer Company?
(A) To pay the personal income tax obligations of the executive FPO board directors
(B) To distribute direct cash grants evenly among non-member households in the village
(C) To enhance the financial base of the FPO and leverage bank loans
(D) To purchase luxury commercial vehicles for the personal use of board directors

64. The 'Mahila Kisan Sashaktikaran Pariyojana' (MKSP) aims to empower women in agriculture. This scheme is a sub-component of which major rural development programme?
(A) Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGA)
(B) Pradhan Mantri Fasal Bima Yojana Crop Insurance Scheme (PMFBY)
(C) Pradhan Mantri Kisan Samman Nidhi Direct Income Scheme (PM-KISAN)
(D) Deendayal Antyodaya Yojana - National Rural Livelihoods Mission (DAY-NRLM)

65. The SHG-Bank Linkage Programme, which revolutionised the micro-credit and women's empowerment movement in rural India, was pioneered by:
(A) Reserve Bank of India (RBI Rural Credit Division)
(B) State Bank of India (SBI Lead Bank Scheme)
(C) National Bank for Agriculture and Rural Development (NABARD)
(D) Asian Development Bank (ADB Microfinance Cell)

66. A typical Self Help Group (SHG) formed for rural women empowerment and livelihood generation usually consists of how many members?
(A) 2 to 5 members
(B) 10 to 20 members
(C) 50 to 100 members
(D) More than 200 members

67. Read the given Assertion (A) and Reason (R) carefully.
Assertion (A): Women's empowerment is highly crucial for the success of rural development programmes in Uttar Pradesh.
Reason (R): Women contribute to a significant proportion of agricultural operations, allied activities, and rural household management.
(A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
(B) Both Assertion (A) and Reason (R) are true but R is not the correct explanation of A.
(C) Assertion (A) is true but Reason (R) is false.
(D) Assertion (A) is false but Reason (R) is true.

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68. The step-by-step process of extension programme planning must always begin with:
(A) Collection of basic facts and analysis of the local situation
(B) Immediate execution and physical field implementation of the plan
(C) Final summative evaluation and impact assessment of the project
(D) Allocation and direct distribution of agricultural subsidies

69. Match the extension planning terms in List I with their accurate descriptions in List II.
List I: (Extension Planning Term)
P. Objective
Q. Goal
R. Plan of Work
S. Calendar of Operations
List II: (Description)
1. A time-bound outline of activities specifying who, what, when, and where
2. A chronological schedule of events and tasks in a specific period
3. A broad statement of a direction of movement
4. A specific distance to be covered in a given direction within a given time
(A) P-3, Q-4, R-1, S-2
(B) P-4, Q-3, R-2, S-1
(C) P-3, Q-1, R-4, S-2
(D) P-1, Q-2, R-3, S-4

70. In extension program planning, "to double the sugarcane yield of 50 farmers in village X by the year 2025" is best described as a:
(A) Goal
(B) Broad Objective
(C) Philosophy
(D) Principle

71. An evaluation conducted continuously during the implementation of an extension programme to make mid-course corrections is known as:
(A) Summative evaluation
(B) Ex-post evaluation
(C) Impact assessment

ANSWERS

1. (C) Latin words 'ex' meaning 'out' and 'tensio' meaning 'stretching'
The term extension originates from two Latin roots: ex, which signifies out, and tensio, which denotes stretching. Thus, the literal etymological meaning of extension is stretching out. In educational contexts, it signifies extending knowledge beyond standard institutional classrooms to reach rural communities, helping farmers apply scientific innovations directly within their farms and daily working environments.

2. (B) Non-formal, out-of-school education for behavioral change
Agricultural extension operates as a non-formal educational framework conducted outside traditional classroom settings. It targets adult rural producers and farm families, aiming to bring positive behavioral changes regarding knowledge, skills, and attitudes. Unlike formal schooling with strict curricula, this system maintains flexible, learner-centered instruction adapted directly to immediate practical needs, local agro-ecological realities, and real-time field problem solving.

3. (D) To bring about desirable changes in the human behavior of farmers
The fundamental objective of agricultural extension at the village level centers on modifying human behavior through persistent educational efforts. These behavioral changes encompass three essential operational dimensions: knowledge gain regarding modern farm practices, development of practical technical skills, and cultivation of favorable attitudes toward innovative agricultural methodologies. Enhancing rural capacities ultimately yields long-term socio-economic progress across farming communities.

4. (A) Extension programmes must be planned and executed with the active involvement of the local people
Active public participation serves as a cornerstone of successful agricultural extension work. The principle of participation dictates that developmental plans must not be imposed externally; rather, local farmers should actively engage in identifying problems, formulating local action strategies, executing field activities, and evaluating results. Such inclusive engagement fosters broad community ownership, self-reliance, and long-term program sustainability.

5. (C) Principle of Grass-roots approach
The grass-roots principle dictates that extension programming must initiate from where people currently stand, utilizing existing local knowledge, skills, financial capability, and material resources. By grounding technical interventions in present baseline conditions, extension workers construct realistic developmental efforts that match community capacities, ensuring that proposed agricultural improvements remain practical, culturally acceptable, accessible, and sustainable for local farming populations.

6. (C) I and III only
Agricultural extension relies on foundational principles ensuring long-term community development. Building mutual trust between workers and farmers forms an essential basis for effective knowledge exchange. Program adaptability guarantees that extension interventions can adjust dynamically to changing environmental, social, or economic conditions. Conversely, extension functions as a continuous, lifelong educational process rather than a short-term, single-crop activity ending abruptly after harvest.

7. (D) Cognitive, Affective, and Psychomotor
Human educational development through agricultural extension targets three core learning domains. The cognitive domain involves intellectual development and technical knowledge acquisition. The affective domain focuses on changing feelings, values, appreciation, and personal attitudes toward innovative methodologies. The psychomotor domain emphasizes developing physical motor skills, hands-on abilities, and practical performance techniques essential for carrying out agricultural practices efficiently in field operations.

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(C) Nagar Panchayat
(D) Kshetra Panchayat

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32. (D) Government machinery and local human/ natural resources
Community development is a process wherein local residents unite with public administrative authorities to improve economic, social, and cultural conditions. The strategy relies on combining institutional support, technical assistance, and financial backing from government machinery with the active participation, enthusiasm, indigenous knowledge, labor, and natural resources of the local population to bring about overall community transformation.

33. (C) Felt needs
Sustainable community development programs succeed when designed around the felt needs of local people. Felt needs represent real, conscious desires, conscious gaps, and prioritized concerns identified directly by community members themselves. Programs addressing genuine felt needs generate high motivation, enthusiastic local participation, strong community ownership, and sustained resource commitment, ensuring far greater success than top-down, externally imposed development projects.

34. (B) Imposed needs - Needs generated organically by the farmers without external influence
Needs assessment forms the foundation of extension programming. Felt needs are consciously recognized and desired by local communities. Unfelt needs are actual problems existing within the community that residents do not yet recognize due to lack of knowledge. Imposed needs are developmental priorities introduced or mandated by external agencies or administrative authorities rather than organic demands arising from local farmers.

35. (A) IV, III, I, II
Indian rural reconstruction evolved through significant historical experiments. Rabindranath Tagore initiated the Sriniketan Project in 1921. F.L. Brayne started the Gurgaon Project in Punjab in 1920. Albert Mayer established the Etawah Pilot Project in Uttar Pradesh in 1948. Subsequently, the Government of India launched the nationwide Community Development Programme on October 2, 1952.

36. (A) F.L. Brayne
The Gurgaon Project was initiated in 1920 by Frank Lugard Brayne, the Deputy Commissioner of Gurgaon district in Punjab. It represented an early systematic rural reconstruction effort targeting agricultural improvement, health, sanitation, waste management, and village education. Brayne introduced village guides to act as extension change agents, laying significant foundations for subsequent rural development operational models across post-independence India.

37. (C) 2nd October 1952
The Community Development Programme was officially launched across India on October 2, 1952, coinciding with Mahatma Gandhi's birth anniversary. Inaugurated with 55 community projects across the country, it aimed at comprehensive social and economic transformation of rural life. CDP emphasized self-help, agricultural expansion, infrastructure creation, public health, and local community mobilization through organized administrative development blocks.

38. (A) P-4, Q-3, R-2, S-1
Pre-independence rural reconstruction movements laid the groundwork for modern extension systems. Spencer Hatch established the Marthandam Project in Tamil Nadu focusing on self-help poultry and cottage industries. Rabindranath Tagore founded the Sriniketan Institute in Bengal. Mahatma Gandhi established the Sewagram project in Maharashtra promoting village self-reliance. T. Prakasam launched the government-backed Firka Development Scheme in Madras Presidency.

39. (D) Indian Council of Agricultural Research (ICAR)
The Indian Council of Agricultural Research functions as the autonomous apex national body overseeing, coordinating, and directing agricultural research, education, and extension transfer of technology across India. Operating under the Union Ministry of Agriculture & Farmers Welfare, ICAR manages a nationwide network of national research institutes, central universities, and funding frameworks supporting Krishi Vigyan Kendras across all agricultural districts.

40. (B) Director of Extension Education
In State Agricultural Universities, the Directorate of Extension Education serves as the principal wing responsible for planning, coordinating, and executing agricultural technology transfer

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8. (B) Psychomotor domain (Skill)
The psychomotor domain of learning encompasses physical skills, manual dexterity, and the precise execution of physical tasks requiring coordinated neuromuscular movements. Demonstrating and teaching physical operations, such as handling cutting tools, seed set selection, chemical preparation, and physical dipping procedures, trains muscular coordination and motor mastery. This direct hands-on instruction creates procedural competence essential for proper farm operation execution.

9. (C) Overall qualitative and quantitative improvement in the living standards of rural people
Rural development is a multi-dimensional strategy designed to improve economic and social well-being across rural populations. Its primary conceptual objective focuses on elevating living standards by increasing income levels, upgrading physical infrastructure, enhancing health and educational access, and empowering local communities. It goes beyond simple agricultural expansion to foster comprehensive, equitable human development across rural regions.

10. (D) Space exploration development (satellite launching capabilities)
Comprehensive rural development encompasses interconnected socio-economic and structural sectors directly impacting rural livelihoods. Core dimensions include economic development through income-generating activities, social development targeting education, healthcare, and welfare, alongside infrastructure expansion involving rural roads, electrification, and sanitation facilities. Specialized technological fields like space exploration and satellite launch systems lie outside the scope of village-level rural progress efforts.

11. (A) Growth refers to an increase in physical output or income, whereas development includes growth along with positive social and structural changes
In economic and social analysis, growth represents a quantitative measurement, such as rising agricultural output or higher per capita income. Development is a broader qualitative concept encompassing economic growth alongside fundamental structural, institutional, and social transformations. While growth focuses primarily on numerical expansion of goods, development incorporates improvements in literacy, public health, living standards, equity, and overall human well-being.

12. (B) Eradicating rural poverty by providing income-generating assets to the poorest of the poor
The Integrated Rural Development Programme was introduced as a major direct anti-poverty initiative in India. It targeted families falling below the poverty line, specifically identifying the poorest households in rural areas. The central mechanism provided financial subsidies and subsidized institutional bank credit to acquire productive income-generating assets, enabling smallholders and landless laborers to cross the poverty threshold permanently.

13. (B) Planning starts at the grassroots or village level and moves upwards to higher administrative levels
The bottom-up planning approach reverses traditional top-down administrative models by placing grassroots communities at the center of program design. Local farmers and villagers analyze their own needs, prioritize problems, and evaluate available resources. This decentralized data moves upward through administrative tiers to construct regional and national development blueprints, ensuring policies accurately address local realities and community preferences.

14. (A) Agricultural extension acts as a critical educational vehicle to achieve the broader goals of rural development
Agricultural extension serves as an essential operational instrument for achieving rural development objectives. While rural development aims for broad socio-economic transformation, extension provides the educational mechanism that delivers technical knowledge, fosters skill development, and promotes innovative farming practices. By increasing agricultural productivity and rural incomes, extension activities drive economic growth, thereby advancing overall rural development outcomes across farm households.

15. (A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
Agricultural extension and rural development maintain a symbiotic relation where each reinforces the other. Extension enhances farm productivity by disseminating modern agricultural technologies and practices to

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I. e-NAM connects existing APMC mandis to create a unified national market.
II. Kisan Suvidha App provides information on weather, dealers, and market prices.
III. 'e-Ganna' app in UP facilitates sugarcane farmers with purchi (supply ticket) details.
IV. 'Bhu-Naksha' portal is primarily for buying certified sugarcane seeds online.

Which combination of the above statements is correct regarding the application of IT in extension?
(A) I, II and III
(B) I, II and IV
(C) II, III and IV
(D) I, III and IV

54. In the context of rural leadership, a leader who allows the group to make all decisions without giving any direction or guidance is exhibiting which style of leadership?
(A) Laissez-faire style
(B) Autocratic leadership
(C) Democratic leadership
(D) Bureaucratic leadership

55. A progressive sugarcane grower in a UP village who adopts new early-maturing varieties like Co 0238 first, and whose advice is actively sought by other villagers, acts as a:
(A) Traditional Laggard / Non-adopter
(B) Formal Administrative Official
(C) External Change Agent / Facilitator
(D) Key Communicator / Opinion Leader

56. Which sociological method is most commonly used by extension workers to scientifically identify natural leaders or opinion leaders within a village community?
(A) Spectrophotometry
(B) Sociometry
(C) Chromatography
(D) Photogrammetry

57. The prominent 'Diffusion of Innovations' theory, which categorizes farmers based on their time of adopting a new technology, was proposed by:
(A) A.W. van den Ban
(B) B.E. Swanson
(C) Everett Rogers
(D) O.P. Dahama

58. Select the correct sequence of the five adopter categories defined in the Diffusion of Innovations model, from earliest to adopt to latest.
(A) Innovators → Early Majority → Early Adopters → Late Majority → Laggards
(B) Innovators → Early Adopters → Early Majority → Late Majority → Laggards
(C) Early Adopters → Innovators → Late Majority → Early Majority → Laggards
(D) Innovators → Early Adopters → Laggards → Early Majority → Late Majority

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59. According to the normal distribution of adopter categories in a social system, what percentage of farmers typically fall into the 'Early Adopters' category?
(A) 13.5% of total farmers
(B) 2.5% of total farmers
(C) 34.0% of total farmers
(D) 16.0% of total farmers

60. Under the Companies Act, what is the minimum number of primary producers required to register a new Farmer Producer Company (FPC/FPO)?
(A) 5
(B) 10
(C) 25
(D) 50

61. At the national level, which central agency is designated as the nodal organization for promoting and creating Farmer Producer Organizations (FPOs)?
(A) Food Corporation of India (FCI)
(B) Small Farmers' Agribusiness Consortium (SFAC)
(C) Agricultural and Processed Food Products Export Development Authority (APEDA)
(D) Commission for Agricultural Costs and Prices (CACP)

62. Consider the following statements regarding the benefits of collective organization through Farmer Producer Organizations (FPOs):
I. FPOs enable small and marginal farmers to achieve economies of scale in input purchasing.
II. FPOs completely transfer land ownership from individual farmers to the government.
III. FPOs increase the bargaining power of farmers during the marketing of their produce.

Which combination of the above statements is correct?
(A) I and II only
(B) II and III only
(C) I and III only

technical agricultural knowledge, demonstrates modern farming methods, assists with welfare scheme enrollment, facilitates input delivery, and channels local farm problems upward to higher development authorities for resolution.

24. (A) P-2, Q-4, R-1, S-3
Extension communication methodologies are systematically categorized based on group reach and pedagogical format. Farm and home visits represent individual contact methods for personalized guidance. Method demonstrations involve group contacts showing step-by-step technical procedures. Kisan Melas serve as mass contact events attracting large farming crowds. Traditional media like puppet shows utilize indigenous folk art to convey agricultural extension messages effectively.

25. (C) "Helping people to help themselves"
The core philosophy of agricultural extension education rests on the fundamental principle of helping people to help themselves. Extension seeks to build internal capacity and self-reliance among rural populations rather than creating continuous external dependency. By providing education, practical technical training, and scientific guidance, extension empowers farmers to diagnose their own issues, make informed decisions, and solve local problems independently.

26. (D) Coercion and mandatory compliance
Extension philosophy is deeply rooted in democratic values, educational persuasion, and mutual respect. It respects the individual intelligence, experience, and capability of farmers, promoting scientific knowledge and evidence-based decision-making. Coercion, authoritarian mandates, and forced compliance violate extension principles, which emphasize voluntary adoption through self-conviction, educational guidance, participative learning, and individual capability building across rural communities.

27. (B) II, III and IV
Extension education rejects paternalism in favor of developing rural self-reliance and autonomous problem-solving capabilities. Its philosophy embraces pragmatism, stressing practical learning by doing and seeing is believing. Furthermore, extension recognizes the farm family as the basic operational unit of development and advocates continuous, lifelong learning for all demographic groups within rural societies to achieve sustained agricultural progress.

28. (B) Robert Chambers
Participatory Rural Appraisal was pioneered and widely popularized by British development scholar Robert Chambers during the late 1980s and 1990s. PRA methodologies revolutionized extension work by shifting control from outside experts to local rural people, enabling villagers to analyze their own life conditions, share baseline knowledge, map local resources, prioritize operational needs, and plan development interventions interactively.

29. (B) A systematic walk with local people through the village to observe and discuss spatial distribution of resources
A Transect Walk is a key spatial technique utilized in Participatory Rural Appraisal. It involves a systematic walk along a predetermined cross-sectional path through a village alongside local key informants. During the walk, participants observe, ask questions, identify agro-ecological zones, analyze land use patterns, inspect soil variation, assess crop conditions, and map water and infrastructure resources interactively.

30. (A) Timeline / Historical Profile
A Timeline or Historical Profile is a temporal PRA tool used to capture past events, trends, and chronological changes within a community over extended periods. By tapping into the collective memory of village elders, extension workers can document historical pest disease outbreaks, climate shifts, adoption of crop varieties, major infrastructural changes, and past agricultural crises across several decades systematically.

31. (A) P-3, Q-1, R-2, S-4
Participatory Rural Appraisal tools serve specialized analytical purposes. Seasonal calendars chart monthly trends in rainfall, agricultural labor, and cropping patterns. Venn diagrams illustrate local institutional linkages, power relations, and organization importance. Wealth ranking evaluates socio-economic stratification and relative prosperity among households. Resource mapping documents physical spatial assets like water bodies, land types, forests, and infrastructure across village territories.

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farmers. Higher agricultural productivity directly increases farm income, generating surplus capital for household consumption, healthcare, education, and investment in local infrastructure. Consequently, extension functions as a primary economic driver explaining broader rural development progress.

16. (D) Two-way communication bridge
The agricultural extension system functions as a dynamic two-way communication bridge linking agricultural research scientists with farming communities. Downwardly, it translates complex scientific innovations into practical recommendations that farmers can easily understand and adopt. Upwardly, it gathers field-level agricultural problems, feedback, and constraint data from farmers' fields, transmitting this information back to research stations for targeted scientific inquiry and resolution.

17. (C) The feedback mechanism in extension
Transmitting field problems back from farmers to research centers exemplifies the feedback mechanism of extension education. Extension is not a one-directional dissemination tool; it continuously collects ground realities, disease reports, and operational constraints from agricultural fields. Transmitting these observations back to research institutes ensures scientists stay informed about real-world conditions, allowing them to refine technologies and develop practical solutions.

18. (B) It involves dictating and forcing farmers to adopt a specific crop variety.
Extension education fundamentally rejects coercion, authoritarian control, or forced mandates. Its philosophy relies entirely on voluntary participation, democratic decision-making, and educational persuasion. Extension workers assist agricultural producers by providing scientific choices, technical knowledge, and skill training, thereby empowering farmers to analyze options independently and select agricultural solutions that best fit their personal farming goals, social context, and economic capabilities.

19. (A) Situation → Objectives → Teaching → Evaluation → Reconsideration
The extension education process is a continuous, cyclic five-step educational framework. It begins with analyzing the current situation, including local facts and problems. Next, objectives and solutions are determined. Educational teaching plans are then executed using appropriate extension methods. Subsequently, evaluation assesses the results against objectives. Finally, reconsideration reviews the process to guide future planning phases, restarting the cycle.

20. (A) Teaching and Action
Implementing field demonstrations represents the practical teaching and action phase of the extension education process. Once situational facts are analyzed and developmental objectives are defined, extension workers create learning opportunities to demonstrate improved technologies. Performing method or result demonstrations actively engages farmers, visually illustrating technical procedures and convincing producers of the tangible economic benefits of adopting modern agronomic practices.

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21. (C) Evaluation
Evaluation in extension education is the systematic process of measuring progress, assessing outcomes, and determining the degree to which predefined objectives have been accomplished. It compares actual field achievements against target goals set during early planning stages. Evaluating educational outputs identifies implementation strengths, exposes procedural shortcomings, highlights behavioral shifts among targeted farmers, and provides evidence-based guidance for future program refinements.

22. (A) Albert Mayer
The Etawah Pilot Project was launched in 1948 at Mahewa in the Etawah district of Uttar Pradesh under the leadership of American architect and town planner Albert Mayer. Designed to test methods for comprehensive village upliftment, it introduced the concept of the multi-purpose village-level worker, laying the operational foundation and administrative principles for India's national Community Development Programme.

23. (D) To act as a multi-purpose village worker bridging government schemes and rural households
A frontline extension official or Gram Panchayat level agricultural worker serves as a multi-purpose change agent directly linking governmental departments with rural families. Acting as the primary liaison, this worker disseminates

activities. The Director of Extension Education heads this division, providing administrative and technical leadership to bridge university research laboratories with farming communities, overseeing frontline training, managing district advisory centers, and guiding university extension specialists.

41. (A) I and II only
The national extension hierarchy involves multiple complementary administrative tiers. At the central government level, the Directorate of Extension under the Ministry of Agriculture handles policy formulation and coordination. State Departments of Agriculture deliver grassroots extension work, distribute inputs, and manage field staff. Non-Governmental Organizations actively participate in agricultural extension, rendering statement III false while validating statements I and II.

42. (D) 1974 at Pondicherry (Puducherry)
The first Krishi Vigyan Kendra in India was established in 1974 at Pondicherry (now Puducherry). Administered under the administrative control of the Tamil Nadu Agricultural University, Coimbatore, this vocational training institute was created to test and demonstrate location-specific agricultural technologies, providing practical hands-on skill training to local farmers, farm women, and rural youth.

43. (A) Dr. Mohan Singh Mehta Committee
The concept and operational design of Krishi Vigyan Kendras were recommended by the Dr. Mohan Singh Mehta Committee, appointed by the Indian Council of Agricultural Research in 1973. The committee envisioned vocational institutional frameworks at the district level to deliver hands-on technical training, execute agricultural technology assessments, and facilitate rapid dissemination of location-specific farm innovations.

44. (B) I, II and IV
The mandatory responsibilities of Krishi Vigyan Kendras center on technology evaluation, demonstration, and human capacity building. KVKs conduct On-Farm Testing to evaluate site specificity of agricultural innovations, organize Frontline Demonstrations to establish production potential, and provide capacity training for farmers and extension personnel. Legal enforcement of state marketing laws lies entirely outside the mandate of KVKs.

45. (B) Indian Council of Agricultural Research (ICAR)
Krishi Vigyan Kendras across all states, including Uttar Pradesh, operate under the institutional framework and one-hundred-percent central financial support of the Indian Council of Agricultural Research. Although host institutions running individual KVKs may vary between State Agricultural Universities, ICAR institutes, and non-governmental organizations, operational funds, infrastructure grants, and staff salaries are fully funded by ICAR.

46. (A) Agricultural Technology Management Agency
ATMA stands for Agricultural Technology Management Agency. Introduced during the late 1990s as an institutional innovation, ATMA operates at the district level to integrate technology dissemination across key farming-related departments, including agriculture, horticulture, animal husbandry, and fisheries. It operates as a registered autonomous society promoting decentralized, farmer-driven, and multi-agency extension operational strategies.

47. (C) District Magistrate (DM) / Collector
Under the governance framework of the Agricultural Technology Management Agency at the district level, the Governing Board serves as the policy-making body. The District Magistrate or District Collector chairs this board, ensuring inter-departmental coordination, approving Strategic Research and Extension Plans, allocating financial resources, and overseeing the execution of multi-sectoral extension activities across the district.

48. (D) Block Technology Team (BTT)
Within the ATMA operational structure, the Block Technology Team functions as the technical execution unit at the block level. Comprising subject matter officers from line departments such as agriculture, horticulture, livestock, and fisheries, the BTT is responsible for preparing the annual Block Action Plan and integrating local technical services to meet farming needs directly.

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off-farm training occurs in institutional centers
(B) On-farm training relies on theoretical lectures; off-farm training relies on practical field exercises
(C) On-farm training is targeted at landless laborers; off-farm training is targeted at progressive landowners
(D) On-farm training emphasizes crop marketing; off-farm training emphasizes agricultural production methods

20. Match the extension aids in List I with their appropriate category in List II:
List I: (Extension Aid)
P. Poster
Q. Slide Projector
R. Television
S. Podcast
List II: (Category)
1. Audio-visual aid
2. Audio aid
3. Projected visual aid
4. Non-projected visual aid
(A) P-4, Q-3, R-1, S-2
(B) P-3, Q-4, R-1, S-2
(C) P-4, Q-1, R-3, S-2
(D) P-2, Q-3, R-1, S-4

21. Krishi Vigyan Kendras (KVKs) are primarily mandated to provide training to which of the following target groups?
(A) Practicing farmers and farm women
(B) Rural youth
(C) Extension personnel
(D) All of the above

22. Read the following statements carefully and select the correct option:
Statement I: mKisan is a Government of India portal that provides SMS advisories to farmers in local languages.
Statement II: Accessing mKisan advisories requires the farmer to possess a high-end smartphone with high-speed internet.
(A) Statement I is correct, but Statement II is incorrect.
(B) Statement I is incorrect, but Statement II is correct.
(C) Both statements are correct.
(D) Both statements are incorrect.

23. What is the main distinction between a Farm School and a traditional classroom training session?
(A) Farm Schools prioritize theoretical instruction and written end-term examinations
(B) Farm Schools conduct practical learning in crop fields across the growing season
(C) Farm Schools offer post-graduate academic programs exclusively for university scientists
(D) Farm Schools rely entirely on mass media tools and radio broadcasts for instruction

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24. Select the correct sequential order of steps in the extension program planning process:
(A) Analysis of situation → Objectives → Execution → Evaluation → Reconsideration
(B) Objectives → Execution → Analysis of situation → Reconsideration → Evaluation
(C) Execution → Objectives → Evaluation → Analysis of situation → Reconsideration
(D) Analysis of situation → Evaluation → Execution → Objectives → Reconsideration

25. Consider the following objectives regarding agricultural training:
I. Upgrading technical knowledge
II. Enhancing practical skills
III. Changing attitudes towards modern agriculture
IV. Disbursing agricultural credit
Which of the above statement(s) is/are correct?
(A) I, II, and IV only
(B) I, II, and III only
(C) II, III, and IV only
(D) I, III, and IV only

26. The sugarcane department launches an intensive, time-bound, area-wide drive to educate farmers on managing red rot disease. This extension activity is best termed as a:
(A) Campaign
(B) Method demonstration
(C) Symposium
(D) Brainstorming session

27. What is the key functional difference between a poster and a chart used in extension?
(A) Charts generate immediate visual awareness; posters detail systematic instructional processes
(B) Posters generate immediate visual awareness; charts detail systematic processes or facts
(C) Posters belong to projected extension aids; charts belong to non-projected instructional

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58. (B) Innovators → Early Adopters → Early Majority → Late Majority → Laggards
In Everett Rogers' Diffusion of Innovations theory, individuals within a social system adopt new ideas at varying speeds along a bell-shaped curve. The chronological sequence begins with Innovators, followed by Early Adopters, then Early Majority, Late Majority, and finally Laggards. This sequence reflects decreasing risk tolerance, varying information exposure, and changing social influence over time.

59. (A) 13.5% of total farmers
Under the statistical distribution of adopter categories modeled by Rogers, the population is divided into five standardized segments: Innovators comprise 2.5%, Early Adopters account for 13.5%, Early Majority represent 34.0%, Late Majority constitute 34.0%, and Laggards make up 16.0%. Early Adopters serve as key local opinion leaders guiding broader community adoption.

60. (B) 10
Under the provisions of the Companies Act, a Farmer Producer Company can be incorporated by ten or more primary producers, two or more producer institutions, or a combination thereof. This statutory requirement establishes a corporate legal entity owned and governed by agricultural producers themselves, enabling smallholders to aggregate produce, enhance market access, and secure institutional funding.

61. (B) Small Farmers' Agribusiness Consortium (SFAC)
The Small Farmers' Agribusiness Consortium, an autonomous society under the Ministry of Agriculture & Farmers Welfare, functions as the central nodal agency for promoting and nurturing Farmer Producer Organizations nationwide. SFAC provides equity grants, credit guarantee support, and administrative guidance to build sustainable agribusiness enterprises owned and managed directly by primary agricultural producers across India.

62. (C) I and III only
Farmer Producer Organizations offer significant collective economic advantages for smallholder agriculture. By aggregating purchasing power, FPOs achieve economies of scale, lowering per-unit input costs for seed, fertilizer, and machinery. Furthermore, volume pooling enhances collective bargaining strength during marketing. FPOs do not alter private land ownership structures or transfer farmer land titles to government entities, making statement II incorrect.

63. (C) To enhance the financial base of the FPO and leverage bank loans
The Equity Grant Scheme for Farmer Producer Companies matches the equity capital raised by primary producer members up to defined statutory limits. This financial support strengthens the company's capital base, enhances its net worth, and increases creditworthiness. A stronger financial foundation allows FPOs to leverage institutional bank loans for working capital, post-harvest infrastructure, and processing expansion.

64. (D) Deendayal Antyodaya Yojana - National Rural Livelihoods Mission (DAY-NRLM)
The Mahila Kisan Sashaktikaran Pariyojana was launched as a specialized sub-component under the Deendayal Antyodaya Yojana - National Rural Livelihoods Mission by the Ministry of Rural Development. MKSP seeks to empower female agricultural workers by improving their technical capacities, promoting sustainable ecological farming practices, enhancing access to land resources, and securing institutional credit and market participation.

65. (C) National Bank for Agriculture and Rural Development (NABARD)
The SHG-Bank Linkage Programme was conceptualized, piloted, and launched in 1992 by the National Bank for Agriculture and Rural Development. NABARD pioneered this micro-finance mechanism to link informal women's Self Help Groups directly with commercial and regional rural banks. The initiative revolutionized rural credit delivery, fostering financial inclusion, household savings, and micro-entrepreneurship among rural women.

66. (B) 10 to 20 members
A standard Self Help Group formed under rural livelihood development models typically consists of 10 to 20 members, usually rural women from similar socio-economic backgrounds. In difficult geographic terrains like hilly or desert regions, the minimum membership requirement may be lowered to 5. This group size ensures democratic participation, effective internal peer oversight,

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and KVK scientists on farmers' fields.
Reason (R): The objective of FLDs is to demonstrate the maximum potential of newly released crop production technologies under field conditions.
(A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
(B) Both Assertion (A) and Reason (R) are true but R is not the correct explanation of A.
(C) Assertion (A) is true but Reason (R) is false.
(D) Assertion (A) is false but Reason (R) is true.

38. Which of the following represents a traditional audio-visual extension tool commonly used in rural India to convey social and agricultural messages?
(A) Epidiascope
(B) Flashcards
(C) Flannel graph
(D) Puppetry

39. Select the correct sequence of the elements of the communication process according to David Berlo's widely used model (SMCR):
(A) Source → Message → Channel → Receiver
(B) Channel → Source → Receiver → Message
(C) Message → Receiver → Channel → Source
(D) Receiver → Channel → Message → Source

40. Which of the following is NOT a component or objective of Training Needs Assessment (TNA)?
(A) Identifying knowledge deficiencies among farmers
(B) Determining the skill gaps of extension workers
(C) Fixing the Fair and Remunerative Price (FRP) of sugarcane
(D) Aligning training content with the actual requirements of the target group

41. In extension terminology, which method specifically answers the question "How to do it?"
(A) Result demonstration
(B) Campaign
(C) Exhibition
(D) Method demonstration

42. In extension terminology, which method specifically answers the question "What is the worth or value of this practice?"
(A) Result demonstration
(B) Method demonstration
(C) Poster display
(D) Brainstorming

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43. Consider the following features regarding Farmer Field Schools (FFS):
I. It is a season-long training process.
II. It is based heavily on Agro-Ecosystem Analysis (AESA).
III. It is conducted entirely in formal university classrooms.
IV. It promotes experiential learning and discovery-based learning.
Which of the above statement(s) is/are correct?
(A) I, II, and III
(B) II, III, and IV
(C) I, II, and IV
(D) I, III, and IV

44. What is the major limitation of the individual-contact method in extension?
(A) It fails to build trust between the farmer and the extension worker
(B) It is highly time-consuming and expensive per person reached
(C) It is only effective for literate farmers
(D) It provides zero opportunity for immediate feedback

45. Read the following statements carefully and select the correct option:
Statement I: A leaflet is typically a single sheet of paper containing preliminary information on a specific topic.
Statement II: A folder is a single sheet of paper folded once or more to provide structured information.
(A) Statement I is correct, but Statement II is incorrect.
(B) Statement I is incorrect, but Statement II is correct.
(C) Both statements are correct.
(D) Both statements are incorrect.

46. An extension officer organizes a 'Kisan Goshthi' in a village to discuss strategies for sugarcane autumn planting. This falls under which category of extension?
(A) Individual contact method
(B) Mass contact method
(C) Group contact method
(D) Cyber extension method

47. The National Institute of Agricultural Extension Management (MANAGE), a premier institute for capacity building of extension personnel, is headquartered at:
(A) New Delhi

75. (A) M.S. Swaminathan
The term Evergreen Revolution was coined by eminent agricultural scientist Dr. M.S. Swaminathan. He advocated for expanding agricultural productivity continuously while safeguarding ecological integrity. Unlike early Green Revolution techniques that sometimes caused soil degradation, water depletion, or chemical pollution, the Evergreen Revolution emphasizes ecological sustainability, integrated pest management, organic practices, and climate-resilient resource conservation for long-term food security.

76. (C) I and III only
Sustainable agricultural development integrates environmentally sound practices that protect natural resources while maintaining crop productivity. Implementing Integrated Pest Management reduces synthetic chemical pesticide usage, safeguarding agro-ecosystems. Adopting precision irrigation like drip systems and trench planting enhances water productivity. Conversely, continuous monocropping depletes soil nutrients, increases pest susceptibility, and degrades land health, making statement II unsustainable.

77. (B) 73rd Amendment Act, 1992
The 73rd Constitutional Amendment Act, 1992, conferred constitutional status upon Panchayati Raj Institutions in India. By inserting Part IX and the Eleventh Schedule into the Constitution, it established a standardized three-tier local self-governance structure. The amendment empowered rural local bodies with administrative powers and financial authority to execute local economic development and social justice programs across rural communities.

78. (A) Balwant Rai Mehta Committee
The Balwant Rai Mehta Committee was appointed in 1957 to examine the functioning of the Community Development Programme. The committee recommended the establishment of democratic decentralization through a three-tier Panchayati Raj system: Gram Panchayat at the village level, Panchayat Samiti at the block level, and Zila Parishad at the district level, forming the foundation of democratic governance.

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79. (A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
The 73rd Constitutional Amendment Act empowered Gram Panchayats to plan and execute economic development and social welfare initiatives. Grassroots planning ensures development programs directly align with local needs, village priorities, and resource availability. Decentralization shifts decision-making authority closer to citizens, explaining why constitutional empowerment of Gram Panchayats leads to effective, tailored, and sustainable rural development outcomes across local communities.

80. (D) Kshetra Panchayat
Under the three-tier Panchayati Raj system instituted in Uttar Pradesh under state legislation, local governance operates across three administrative tiers. The Gram Panchayat functions at the village level, the Kshetra Panchayat serves at the intermediate Development Block level, and the Zila Panchayat operates at the district level. The Kshetra Panchayat coordinates developmental activities between village panchayats and district administration.

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CHAPTER 20
Extension Methods and Training

1. The word 'Extension' is derived from the Latin roots 'ex' and 'tensio'. What does this literally mean?
(A) To teach in a classroom
(B) To stretch out
(C) To cultivate the soil
(D) To train for a job

2. Which of the following is considered an individual-contact method in agricultural extension?
(A) Kisan Mela
(B) Television broadcast
(C) Method demonstration
(D) Farm visit

3. Consider the following statements regarding visual aids in extension:
I. Posters are designed to catch attention and create rapid awareness.
II. A chalkboard is classified as a projected visual aid.
III. Charts are used to systematically display information or processes.
Which of the above statement(s) is/are correct?
(A) I and II only
(B) II and III only
(C) I and III only
(D) I, II, and III

4. Read the following assertion and reason statements carefully and select the correct option:
Assertion (A): A result demonstration operates on the principle of "seeing is believing".
Reason (R): It demonstrates the value or worth of a newly recommended agricultural practice compared to local practices.
(A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
(B) Both Assertion (A) and Reason (R) are true but R is not the correct explanation of A.
(C) Assertion (A) is true but Reason (R) is false.
(D) Assertion (A) is false but Reason (R) is true.

5. The primary objective of establishing a Farmer Field School (FFS) is to:
(A) Facilitate field learning and group problem solving
(B) Provide formal university degrees to young farmers
(C) Distribute seasonal agricultural loans and subsidies
(D) Procure harvested crops directly from local farmers

6. A Cane Supervisor demonstrates the correct technique of sugarcane sett treatment using fungicides. This is an example of which extension method?
(A) Result demonstration
(B) Mass campaign
(C) Field day
(D) Method demonstration

7. Match the extension methods in List I with their classification in List II:
List I: (Extension Method)
P. Farm Visit
Q. Method Demonstration
R. Radio Broadcast
S. Flashcards
List II: (Classification)
1. Mass Contact Method
2. Visual Aid
3. Individual Contact Method
4. Group Contact Method
(A) P-3, Q-4, R-1, S-2
(B) P-4, Q-3, R-1, S-2
(C) P-3, Q-2, R-1, S-4
(D) P-1, Q-4, R-3, S-2

8. Arrange the following steps of extension teaching in the correct sequential order as proposed by Wilson and Gallup (the AIDCAS model):
1. Conviction
2. Attention
3. Action
4. Desire
5. Interest
(A) 2, 5, 4, 1, 3
(B) 1, 2, 3, 4, 5
(C) 2, 4, 5, 1, 3

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(D) 5, 2, 4, 3, 1

9. What is the toll-free number of the Kisan Call Centre (KCC) established by the Government of India for providing agricultural information?
(A) 1800-120-1551
(B) 1800-180-1155
(C) 1800-111-1551
(D) 1800-180-1551

10. Training Needs Assessment (TNA) is defined as the process of identifying the gap between:
(A) Existing knowledge/skills and required field performance levels
(B) Current actual crop yield levels and potential economic yields
(C) Baseline total cultivation costs and market commodity prices
(D) Traditional local farming tools and modern agricultural machinery

11. Which of the following is NOT classified as a mass-contact method?
(A) Large-scale agricultural exhibition
(B) Kisan Goshthi (Farmers' Meeting)
(C) Regional multi-day Kisan Mela
(D) Published local newspaper article

12. Consider the following statements regarding the basic principles of agricultural extension:
I. Principle of cultural difference.
II. Principle of top-down administrative coercion.
III. Principle of learning by doing.
IV. Principle of local leadership.
Which of the above statement(s) is/are correct?
(A) I, II, and III
(B) I, III, and IV
(C) II, III, and IV
(D) I, II, III, and IV

13. The Cone of Experience, a model that relates the type of audio-visual aid to the effectiveness of learning, was developed by:
(A) Edgar Dale
(B) J.P. Leagans
(C) Everett Rogers
(D) O.P. Dahama

14. Read the following assertion and reason statements carefully and select the correct option:
Assertion (A): Farm Schools under the ATMA scheme serve as practical teaching models at the grassroots level.
Reason (R): Farm Schools are generally established on the fields of progressive farmers to promote farmer-to-farmer learning.
(A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
(B) Both Assertion (A) and Reason (R) are true but R is not the correct explanation of A.
(C) Assertion (A) is true but Reason (R) is false.
(D) Assertion (A) is false but Reason (R) is true.

15. Which of the following is exclusively an audio aid?
(A) Television
(B) Cinema
(C) Puppet show
(D) Radio

16. What is the main purpose of an agricultural exhibition (Agri-fair)?
(A) To provide comprehensive individual counseling to every visiting farm family
(B) To perform mandatory statutory financial audits of registered farmer societies
(C) To display modern agricultural technologies, tools, and inputs to the public
(D) To issue customized digital soil health cards directly to all farm attendees

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17. Which of the following methods is considered the most effective for teaching complex practical skills, such as operating a new sugarcane trench planter?
(A) Distributing leaflets
(B) Method demonstration
(C) Radio talk
(D) Circular letter

18. Consider the following steps involved in the Training Needs Assessment (TNA) process:
I. Defining the target group and required competencies.
II. Identifying the current performance or knowledge gaps.
III. Setting the Minimum Support Price (MSP) for the crop.
Which of the above statement(s) is/are correct?
(A) I and III only
(B) II and III only
(C) I and II only
(D) I, II, and III

19. What is the primary difference between on-farm training and off-farm training?
(A) On-farm training occurs in field conditions;

49. (A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
ATMA introduced a paradigm shift from traditional top-down extension to a decentralized, bottom-up participatory framework. This transition is realized through the mandatory formulation of Strategic Research and Extension Plans. SREPs compile comprehensive farming diagnostics starting at village and block levels with active farmer involvement, ensuring district development strategies accurately reflect genuine local agricultural realities.

50. (B) 1800-180-1551
The Kisan Call Centre scheme was launched in January 2004 by the Ministry of Agriculture to deliver immediate advisory services directly to the farming community. Farmers across India can dial the nationwide toll-free number 1800-180-1551 from any network to access agricultural experts speaking in their local languages regarding crop protection, seed selection, weather, and market prices.

51. (D) Daily agricultural commodity prices and market arrivals in APMC mandis
AGMARKNET is a nation-wide digital portal implemented by the Directorate of Marketing and Inspection. It connects wholesale agricultural markets (APMC mandis) across India to capture, standardize, and disseminate real-time market intelligence. The platform provides farmers with transparent, daily information on commodity arrival quantities and ruling market prices, strengthening farmer bargaining capacity and market transparency.

52. (A) Persian Wheel (Rahat)
Modern agricultural extension relies heavily on Information and Communication Technology tools such as smartphone applications, SMS advisory portals, and integrated electronic market networks. The Persian Wheel is a traditional animal-powered mechanical water-lifting device historically used for field irrigation. Unlike mobile apps, SMS portals, or e-NAM, it does not represent modern digital information and communication technology.

53. (A) I, II and III
Digital ICT tools transform extension services across multiple domains. e-NAM unifies APMC mandis online; Kisan Suvidha offers weather, dealer, and pricing data; and UP's e-Ganna app manages sugarcane supply ticket information. However, Bhu-Naksha is a digital land-record mapping software used for spatial parcel visualization, not an e-commerce platform for purchasing certified sugarcane seeds.

54. (A) Laissez-faire style
Laissez-faire leadership, also called free-rein leadership, is characterized by a complete absence of direct guidance or centralized authority from the leader. In this operational style, group members are given full freedom to make decisions, establish goals, and execute tasks independently. The leader acts in a passive role without offering structured direction or active group supervision.

55. (D) Key Communicator / Opinion Leader
An opinion leader or key communicator is a respected member within a local social system who informally influences community decisions. Because of their personal credibility, early adoption of proven farming innovations, and success, fellow villagers frequently seek their advice regarding new practices. They serve as crucial informal information channels for extension agents attempting to accelerate agricultural technology diffusion.

56. (B) Sociometry
Sociometry is a quantitative sociological technique designed to measure social relationships, interpersonal preferences, and informal group structures within a community. Developed by Jacob L. Moreno, sociometric surveys ask community members to specify individuals they prefer to consult for advice or leadership. Analyzing these responses map social choices, reliably identifying central opinion leaders and key communicators.

57. (C) Everett Rogers
The Diffusion of Innovations theoretical framework was formulated by sociologist Everett M. Rogers in his seminal 1962 book. Rogers explained how new technological innovations, scientific ideas, and improved practices spread across social networks over time. He categorized technology adopters into five distinct segments based on relative innovativeness, establishing foundational concepts extensively utilized in agricultural extension work.

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aids
(D) Posters are designed strictly for indoor usage; charts are designed strictly for outdoor usage

28. Read the following assertion and reason statements carefully and select the correct option:
Assertion (A): Mass media methods like radio and newspapers are highly effective for teaching detailed, complex practical skills to farmers.
Reason (R): Mass media provides immediate two-way face-to-face feedback between the farmer and the scientist.
(A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
(B) Both Assertion (A) and Reason (R) are true but R is not the correct explanation of A.
(C) Assertion (A) is true but Reason (R) is false.
(D) Assertion (A) is false but Reason (R) is true.

29. Which of the following is NOT an individual-contact method?
(A) Symposium
(B) Personal letter
(C) Farm clinic
(D) Telephone call

30. In extension teaching, what is the generally recommended number of flashcards in a single set to maintain the audience's attention?
(A) 2 to 4 cards
(B) 10 to 12 cards
(C) 30 to 40 cards
(D) 50 to 60 cards

31. The primary purpose of conducting a 'Field Day' in agricultural extension is to:
(A) Provide formal administrative training to newly recruited extension officers
(B) Demonstrate internal mechanical operations within commercial sugar refining mills
(C) Facilitate distribution of governmental crop insurance claims and relief checks
(D) Showcase proven outcomes of a result demonstration to wider farmer groups

32. Match the training methods in List I with their primary characteristics in List II:
List I: (Training Method)
P. Lecture
Q. Role Play
R. Brainstorming
S. Method Demonstration
List II: (Primary Characteristic)
1. Simulating real-life situations and behaviors
2. Generating a large number of ideas quickly
3. Showing step-by-step how to perform a task
4. Formal one-way presentation of information
(A) P-4, Q-1, R-2, S-3
(B) P-1, Q-2, R-3, S-4
(C) P-4, Q-2, R-1, S-3
(D) P-2, Q-1, R-4, S-3

33. Consider the following types of evaluation used in training programs:
I. Formative evaluation (during training)
II. Summative evaluation (end of training)
III. Statutory financial auditing
Which of the above statement(s) is/are correct?
(A) I and III only
(B) II and III only
(C) I and II only
(D) I, II, and III

34. The e-Choupal initiative, which utilizes internet kiosks for digital agricultural extension and supply chain management, was launched by:
(A) Tata Chemicals
(B) Reliance Industries
(C) Mahindra & Mahindra
(D) ITC Limited

35. What is the main purpose of conducting a pre-training evaluation of the participants?
(A) Benchmark existing participant skills and knowledge prior to instruction
(B) Issue official completion certificates to attendees prior to sessions
(C) Calculate institutional venue costs and operational training budgets
(D) Identify keynote guest speakers for the final valedictory ceremony

NODIA

36. Which national entity is primarily responsible for providing NSQF-aligned skill training and certification specifically in the agriculture sector?
(A) Agricultural and Processed Food Products Export Development Authority (APEDA)
(B) Commission for Agricultural Costs and Prices (CACP)
(C) Agriculture Skill Council of India (ASCI)
(D) Food Corporation of India (FCI)

37. Read the following assertion and reason statements carefully and select the correct option:
Assertion (A): Front Line Demonstrations (FLDs) are typically conducted by researchers

mutual trust, and manageable micro-savings administration.

67. (A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
Gender mainstreaming is crucial for effective rural development. Women perform a substantial portion of agricultural operations, including sowing, weeding, harvesting, post-harvest processing, and livestock management. Empowering rural women through skill enhancement, economic access, and leadership training directly improves household food security, family nutrition, income diversification, and overall community welfare, confirming the causal relationship between female empowerment and rural development.

68. (A) Collection of basic facts and analysis of the local situation
The extension program planning process is a systematic procedure that must begin with gathering baseline facts and analyzing the local situation. Before setting objectives or planning intervention tasks, extension workers must collect accurate socio-economic, agricultural, environmental, and infrastructure data. Thorough situational analysis identifies local problems, baseline constraints, available resources, and community needs, guiding subsequent program planning stages.

69. (A) P-3, Q-4, R-1, S-2
Extension planning terminologies express specific operational concepts. A goal represents a broad direction of movement. An objective defines a specific measurable distance to be covered in a given direction within a designated timeframe. A plan of work outlines who, what, when, and where. A calendar of operations serves as a chronological schedule detailing execution steps.

70. (A) Goal
In extension program planning, a goal is defined as a broader, overarching target or direction towards which long-term efforts are directed. When a statement incorporates specific quantitative targets, geographical locations, targeted beneficiary numbers, and designated timelines, it functions as a defined goal. It provides a clear target for measuring overall achievement during subsequent project evaluation phases.

71. (D) Formative evaluation
Formative evaluation is conducted concurrently during the active implementation of an extension project. Its purpose is to track ongoing activities, detect practical execution bottlenecks, monitor resource utilization, and assess initial audience responses. Performing formative evaluations enables program managers to make necessary mid-course corrections and operational adjustments, ensuring target goals are efficiently attained before program completion.

72. (B) Formative Evaluation - Done after the programme has completely ended
Formative evaluation takes place during the implementation phase of a program to guide ongoing operational improvements. In contrast, evaluation performed after a program has completely ended is called summative or ex-post evaluation, which assesses total impact and goal attainment. Monitoring involves continuous operational tracking, while periodic evaluation evaluates overarching progress toward long-term developmental targets.

73. (C) It helps research scientists modify technologies based on actual field constraints faced by farmers
Maintaining an active feedback mechanism is vital for effective extension communication. Field feedback conveys practical ground realities, adoption barriers, socio-economic constraints, and technology shortcomings directly from farmers back to research institutions. This information flow enables agricultural scientists to modify existing technologies, refine research agendas, and engineer user-friendly, location-specific agricultural solutions that effectively resolve real-world farming challenges.

74. (D) Meeting the needs of the present generation without compromising the ability of future generations to meet their own needs
Sustainable rural development aligns with the classic Brundtland definition of sustainability. It emphasizes managing economic growth, agricultural practices, and natural resource use in a manner that satisfies present societal needs without depleting natural assets or compromising future generations' capacity to fulfill their needs. It promotes soil conservation, water management, environmental protection, and long-term socio-economic equity across rural regions.

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(B) Lucknow
(C) Pune
(D) Hyderabad

48. Match the digital agricultural platforms in List I with their primary function in List II:
List I: (Digital Agricultural Platform)
P. e-NAM
Q. Meghdoot
R. Kisan Suvidha
S. PM-Kisan Portal
List II: (Primary Function)
1. Agrometeorological advisories
2. Direct benefit transfer verification
3. Pan-India electronic trading portal
4. Omnibus mobile app for multiple farmer services
(A) P-3, Q-1, R-4, S-2
(B) P-1, Q-3, R-2, S-4
(C) P-4, Q-2, R-1, S-3
(D) P-3, Q-4, R-1, S-2

49. A 'Circular Letter' sent by the Cane Development Department to thousands of farmers regarding the commencement of the crushing season is classified as a:
(A) Group contact method
(B) Mass contact method
(C) Individual contact method
(D) Visual aid

50. Consider the following statements regarding the role of Farmers' Training Centres (FTCs):
I. FTCs provide short-duration, need-based institutional training to farmers.
II. FTCs are primarily responsible for fixing the statutory minimum wage for farm labor.
III. FTCs contribute to rural capacity building at the district level.
Which of the above statement(s) is/are correct?
(A) I and II only
(B) II and III only
(C) I and III only
(D) I, II, and III

51. In the diffusion of innovations theory, farmers who are the very first to adopt a new agricultural technology in a community are termed as:
(A) Innovators
(B) Early majority
(C) Early adopters
(D) Laggards

52. What is the fundamental requirement for laying out a result demonstration in a farmer's field?
(A) Demonstration plots must cover a mandatory minimum area of ten contiguous hectares
(B) Operational establishment expenses must be fully funded by local sugar refining mills
(C) Clear side-by-side comparison between new methods and traditional check plots is required
(D) Farmers are strictly restricted to using certified high-yielding hybrid seed varieties

53. Which of the following is NOT classified as a visual aid?
(A) Public Address system
(B) Preserved plant specimen
(C) Illustrated flashcard set
(D) Felt-covered flannel graph

54. Which method is most appropriate for changing the deep-rooted negative attitude of skeptical farmers toward a new sugarcane variety?
(A) Distributing leaflets
(B) Radio broadcast
(C) Text message (SMS)
(D) Result demonstration

55. An extension publication containing 24 to 48 pages with comprehensive, detailed information on sugarcane cultivation is technically termed a:
(A) Leaflet
(B) Bulletin
(C) Folder
(D) Circular letter

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56. Using television for releasing an advisory on sugarcane top borer management is highly effective because:
(A) It delivers rapid two-way interpersonal feedback directly between scientists and farm viewers
(B) It enables participating farmers to perform hands-on field trials alongside the broadcast
(C) It merges sound with images to instruct diverse literate and illiterate rural audiences
(D) It serves as a personalized individual extension tool tailored to specific field holdings

57. Read the following statements carefully and select the correct option:
Statement I: Social media groups facilitate the rapid, low-cost sharing of pest outbreak alerts among farming communities.

44. (B) It is highly time-consuming and expensive per person reached
Individual-contact extension methods, such as personal farm visits, provide high-quality interaction and customized advisory, but they require substantial staff time, labor, and travel resources. Consequently, the operational cost and time spent per individual reached are extremely high, severely restricting the total number of farmers an extension worker can engage within a given timeframe.

45. (C) Both statements are correct.
Leaflets and folders are non-projected printed extension publications used to disseminate technical information. A leaflet consists of a single unfolded sheet providing brief, basic details on a specific topic. A folder is also a single sheet, but it is folded one or more times to organize information into logical, structured visual panels for readers.

46. (C) Group contact method
A Kisan Goshthi brings together a group of farmers and extension specialists to discuss relevant agricultural topics, share local experiences, and solve field challenges collectively. Because it involves face-to-face interaction among a small to medium-sized group of participants, it falls squarely under group contact extension methods rather than individual, mass, or digital communication channels.

47. (D) Hyderabad
The National Institute of Agricultural Extension Management, known as MANAGE, is an autonomous organization established under the Ministry of Agriculture and Farmers Welfare, Government of India. Headquartered in Hyderabad, Telangana, MANAGE serves as the apex national institute responsible for extension management policy, high-level capacity building, research, and managerial training for extension personnel.

48. (A) P-3, Q-1, R-4, S-2
Digital portals serve specialized agricultural functions across India. e-NAM functions as a pan-India electronic trading portal uniting agricultural commodity markets. Meghdoot delivers tailored agrometeorological advisories and weather forecasts. Kisan Suvidha is a comprehensive mobile application offering multiple farmer services. The PM-Kisan Portal facilitates direct benefit financial transfers directly into verified bank accounts of eligible farmers.

49. (B) Mass contact method
A circular letter is an official written notification containing uniform information sent simultaneously to a large number of recipients. Because it conveys identical written content to many farmers across a wide geographical area without individual personalization or face-to-face contact, it is classified as a mass contact extension method for generating broad situational awareness.

50. (C) I and III only
Farmers' Training Centres are institutional extension setups dedicated to organizing short-duration, need-based training programs to build practical skills and technical capacity among rural farm communities at the district level. Regulating labor market economics, such as establishing statutory minimum agricultural wages, is a legislative policy function handled by labor departments, completely outside the operational scope of training centers.

51. (A) Innovators
According to Everett Rogers' diffusion of innovations theory, innovators represent the initial subset of individuals in a social system who adopt a new idea or technology. Characterized by venture-someness, high risk tolerance, and access to substantial information sources, innovators are willing to experiment with new farming techniques long before others in their community accept them.

52. (C) Clear side-by-side comparison between new methods and traditional check plots is required
A valid result demonstration requires establishing a direct, side-by-side comparison between a newly recommended practice and an adjacent local control plot under identical field conditions. This explicit layout isolates the variable being evaluated, providing clear, unconfounded visual evidence of superior performance, economic benefits, and yield improvements attributable directly to the recommended modern practice.

53. (A) Public Address system
A Public Address system consists of microphones, amplifiers, and loudspeakers, making it strictly an audio tool designed to amplify spoken sound

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69. Read the following statements carefully and select the correct option:
Statement I: Audio-visual aids are designed to completely replace the extension worker.
Statement II: Audio-visual aids help make abstract agricultural concepts more concrete and understandable for farmers.
(A) Statement I is correct, but Statement II is incorrect.
(B) Statement I is incorrect, but Statement II is correct.
(C) Both statements are correct.
(D) Both statements are incorrect.

70. The Training and Visit (T & V) system of agricultural extension was introduced in India primarily with the assistance of which international organization?
(A) World Health Organization (WHO)
(B) World Trade Organization (WTO)
(C) International Monetary Fund (IMF)
(D) World Bank

71. For a group discussion to be highly effective and allow all members to participate, the ideal number of participants is generally considered to be:
(A) 2 to 3
(B) 10 to 15
(C) 40 to 50
(D) 100 to 200

72. What is the very first step in the systematic process of evaluating a training programme?
(A) Distributing structured assessment questionnaires to program participants
(B) Performing statistical data analysis on collected evaluation feedback
(C) Defining explicit evaluation objectives and performance indicators
(D) Drafting formal evaluation reports for organizational administrators

73. The term 'Cyber Extension' in agriculture specifically refers to:
(A) Applying cyber security measures to safeguard proprietary sugar mill databases
(B) Utilizing computer-aided design software to engineer modern farm machinery
(C) Replacing traditional agricultural farming with synthetic laboratory foods
(D) Applying internet, ICT tools, and digital networks to agricultural extension

74. According to Kirkpatrick's widely accepted four-level model for training evaluation, what is evaluated at Level 1?
(A) Results (Long-term impact on farm crop yields and economic income)
(B) Behavior (Field application of newly acquired agricultural practices)
(C) Learning (Measurable acquisition of agricultural knowledge and skills)
(D) Reaction (Participant satisfaction feedback on training experience)

75. Identify the INCORRECT statement regarding mass contact methods in agricultural extension:
(A) They are highly effective for building rapid awareness across large audiences.
(B) They excel at teaching complex, hands-on practical skills to individuals.
(C) They incur low operational costs per person relative to direct individual visits.
(D) They typically suffer from delayed, limited, or absent two-way communication.

76. A 'Farm Clinic' (or Agricultural Clinic) functions primarily on which extension approach?
(A) Mass communication approach
(B) Individual contact method
(C) Group extension approach
(D) Digital cyber extension method

77. Which of the following is a classic example of a projected visual aid used in extension training?
(A) Opaque projector (Epidiascope)
(B) Felt-covered flannel graph board
(C) Illustrated instructional flashcards
(D) Real crop specimen display case

78. Which statement best describes the focus of the Skill India initiative in the agricultural sector?
(A) Disbursing interest-subsidized short-term agricultural crop credit loans to farmers
(B) Procuring harvested sugarcane directly from agricultural fields at minimum prices
(C) Imparting certifiable vocational skills to rural youth to boost employability
(D) Supplying subsidized electric power to agricultural tube wells for irrigation

79. When a Cane Supervisor visits a specific farmer's field upon request to diagnose a top borer infestation, this extension approach is known as a:
(A) Field day
(B) Result demonstration

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and educate entire communities to solve urgent widespread agricultural issues. By concentrating efforts over a specific timeframe, campaigns effectively raise awareness and prompt swift, collective action across large farming populations to tackle severe threats such as major disease outbreaks, pest infestations, or critical crop management challenges.

27. (B) Posters generate immediate visual awareness; charts detail systematic processes or facts
Posters are visual tools designed with brief text and bold graphics to capture immediate public attention and create rapid awareness. Charts, conversely, provide structured, detailed presentation of complex facts, data, operational steps, or processes. While posters serve primarily as quick motivational reminders, charts function as comprehensive instructional aids during detailed training presentations and group discussions.

28. (D) Assertion (A) is false but Reason (R) is true.
Mass media tools such as radio and newspapers excel at delivering broad awareness quickly to massive audiences, but they lack immediate two-way interaction and physical feedback. Consequently, they are ill-suited for teaching complex, practical physical skills that require hands-on practice, personalized supervision, step-by-step guidance, and real-time correction of technique during actual field operations.

29. (A) Symposium
A symposium is a structured group meeting where several specialists deliver brief presentations on different aspects of a central topic before an audience, classifying it as a group extension method. In contrast, personal letters, farm clinics, and individual telephone calls involve direct one-on-one communication between an extension worker and a specific farmer, fitting individual-contact definitions.

30. (B) 10 to 12 cards
Flashcards are compact visual aids presented sequentially to tell a story or explain a topic step by step to small groups. To maintain audience interest, prevent cognitive overload, and deliver a concise educational message, an ideal flashcard set generally contains between 10 to 12 cards. Using excessive cards risks confusing the audience and diluting main instructional messages.

31. (D) Showcase proven outcomes of a result demonstration to wider farmer groups
A Field Day is an extension event organized to bring groups of farmers to a demonstration site where recommended practices have been successfully implemented. Its primary objective is to showcase tangible visual evidence and crop yield advantages of adopted technologies, reinforcing learning through peer observation, facilitating group interaction, and encouraging widespread technology adoption across local farming communities.

32. (A) P-4, Q-1, R-2, S-3
Instructional methods possess distinct operational features tailored to specific educational objectives. A lecture involves a formal, one-way presentation of information. Role play engages trainees in acting out realistic interpersonal scenarios. Brainstorming encourages rapid generation of diverse creative ideas without immediate criticism. Method demonstrations show step-by-step physical techniques required to master specific practical agricultural operations effectively.

33. (C) I and II only
Training evaluation focuses on educational processes and outcome assessments. Formative evaluation occurs during program delivery to guide ongoing improvements, while summative evaluation takes place at conclusion to measure overall effectiveness and learning achievement. Formal financial auditing involves verifying institutional accounting books and fiscal compliance, forming an administrative accounting function completely distinct from educational evaluation methodologies.

34. (D) ITC Limited
The e-Choupal initiative was launched by ITC Limited to transform agricultural supply chains and empower rural farmers using digital technology. By installing internet kiosks in rural villages, the system delivers real-time weather forecasts, market prices, modern scientific agricultural practices, and direct procurement services, significantly reducing transaction costs and improving farmer profit margins across India.

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ANSWERS

1. (B) To stretch out
The term extension originates from the Latin roots ex meaning out and tensio meaning stretching. Within agricultural education, it signifies stretching out or expanding scientific knowledge from research stations directly to farming communities. This educational outreach assists farmers in adopting modern practices, improving productivity, enhancing rural livelihoods, and solving field problems effectively.

2. (D) Farm visit
Farm visits are classic individual contact methods where an extension agent directly interacts with a single farmer at their field location. This face-to-face contact allows personalized diagnosis of specific crop issues, direct advisory, and mutual trust building. In contrast, mass broadcasting and group demonstrations serve larger numbers of participants simultaneously rather than providing direct personal interaction.

3. (C) I and III only
Posters are non-projected visual aids designed to capture quick attention and create rapid widespread public awareness regarding specific agricultural messages. Charts systematically display organized data, processes, and steps to aid understanding during group learning. A chalkboard is classified as a non-projected visual display board rather than a projected visual aid, as it requires no optical projection hardware.

4. (A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
Result demonstrations operate directly on the core educational principle that seeing is believing. They function by establishing side-by-side comparative plots in real field conditions to clearly show the superior performance and economic value of recommended practices against conventional local methods. This convincing visual evidence encourages farmers to adopt proven agricultural technologies with complete confidence.

5. (A) Facilitate field learning and group problem solving
Farmer Field Schools represent a participatory extension approach designed to empower farmers through season-long field learning, ecosystem observation, and collective decision-making. By analyzing real crop conditions through hands-on activities, farmers develop critical problem-solving skills, enhance crop management abilities, and adopt sustainable agricultural techniques suited to their local agro-ecological environments without relying on structured classroom lectures.

6. (D) Method demonstration
Showing step-by-step physical execution of a specific technical skill, such as preparing and treating sugarcane setts using fungicides, exemplifies a method demonstration. This hands-on instructional technique teaches farmers how to perform a task correctly through physical execution, encouraging immediate skill acquisition, operational mastery, and correct adoption of practical agricultural practices under the direct supervision of an instructor.

7. (A) P-3, Q-4, R-1, S-2
Extension tools are systematically categorized by contact range and sensory medium. Visiting individual farms represents an individual contact method for personalized consultation. Conducting method demonstrations serves groups through direct skill training. Radio broadcasts reach mass audiences without direct interaction. Flashcards are non-projected visual tools utilized to display step-by-step instructional concepts sequentially during small group interactions.

8. (A) 2, 5, 4, 1, 3
The classical AIDCAS extension teaching process outlines six sequential psychological steps necessary for effective learning and technology adoption. The process initiates by securing Attention, stirring Interest, generating Desire, building Conviction, leading to concrete Action, and achieving ultimate Satisfaction. Following this logical progression ensures that farm learners transition effectively from passive awareness to active and permanent adoption of modern agricultural practices.

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Statement II: Information spread through social media is inherently 100% scientifically validated and carries no risk of misinformation.
(A) Statement I is correct, but Statement II is incorrect.
(B) Statement I is incorrect, but Statement II is correct.
(C) Both statements are correct.
(D) Both statements are incorrect.

58. A training method where a small group of participants acts out a real-life situation without a formal script to understand human relations or problem-solving is called:
(A) Role play
(B) Brainstorming
(C) Symposium
(D) Panel discussion

59. Which extension approach relies comprehensively on the combined principles of "learning by doing" and "seeing is believing"?
(A) Lecture
(B) Demonstration
(C) Radio listening groups
(D) Circular letters

60. A key characteristic of off-farm training is that:
(A) Trainees must personally fund institutional infrastructure and venue expenses
(B) Instruction occurs in dedicated facilities outside actual farm environments
(C) Sessions take place exclusively during busy crop harvesting seasonal periods
(D) Training protocols strictly prohibit using instructional audio-visual aids

61. The main objective of organizing a 'Kisan Mandal' or Farmers' Club is to:
(A) Provide an organized forum for rural peer learning and resource sharing
(B) Mobilize rural agricultural workers for political campaigning activities
(C) Recruit and deploy permanent government agricultural extension officers
(D) Enforce legal administrative penalties against institutional credit defaulters

62. A chalkboard (or whiteboard) used during a farmer training session is categorized as a:
(A) Projected visual training aid
(B) Integrated audio-visual aid
(C) Non-projected visual aid
(D) Interactive digital visual aid

63. What is the first systematic step in developing effective extension training material (like a manual or chart)?
(A) Selecting suitable commercial printing contractors and press facilities
(B) Distributing preliminary instructional drafts directly to local farmers
(C) Translating technical content into multiple regional and foreign languages
(D) Defining clear learning objectives and analyzing target audience requirements

64. Which of the following is NOT an accepted principle of agricultural extension education?
(A) Principle of grassroots operational approach
(B) Principle of adaptation to cultural changes
(C) Principle of autocratic command leadership
(D) Principle of active community participation

65. An extension strategy that involves an intensive, highly focused teaching activity over a specified period to promote a specific urgent practice (e.g., rat control week) is known as a:
(A) Workshop
(B) Campaign
(C) Farm clinic
(D) Seminar

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66. If an extension worker physically shows farmers the precise technique for making three-budded sugarcane setts, this teaching method is termed:
(A) Result demonstration
(B) Field trip
(C) Group discussion
(D) Method demonstration

67. In the context of agricultural extension, 'Capacity Building' refers to:
(A) Improving knowledge, skills, and capabilities of farm stakeholders
(B) Expanding operational storage volume within rural godown facilities
(C) Upgrading mechanical engine horsepower in village tractor fleets
(D) Increasing total physical landholding acreage of smallholders

68. Which of the following mass media tools traditionally provides ONLY one-way communication without immediate feedback?
(A) Farm visit
(B) Kisan Call Centre (telephone)
(C) Radio broadcast
(D) Farm clinic

interactive physical demonstration necessary for mastering operational technical procedures.

18. (C) I and II only
Conducting a Training Needs Assessment involves identifying target learner groups, analyzing necessary competencies, and evaluating current skill gaps to design relevant instruction. Establishing government economic policies, such as setting Minimum Support Prices for agricultural commodities, falls under national market pricing policy rather than educational assessment methodologies used to plan capacity building initiatives for agricultural extension programs.

19. (A) On-farm training occurs in field conditions; off-farm training occurs in institutional centers
The defining distinction between on-farm and off-farm training lies in the physical learning location. On-farm training takes place directly within real working fields, providing immediate context and practical hands-on experience under actual growing conditions. Off-farm training occurs in structured institutional environments like training centers or classrooms, prioritizing formal lectures, conceptual learning, and controlled group discussions.

20. (A) P-4, Q-3, R-1, S-2
Instructional media are classified based on visual projection and audio capability. Posters are non-projected visual aids designed for direct viewing. Slide projectors require optical equipment to display transparent slides, making them projected visual aids. Television integrates visual images with sound, forming an audio-visual medium. Podcasts distribute audio recordings, classifying them strictly as digital audio learning tools.

21. (D) All of the above
Krishi Vigyan Kendras are institutional vocational training centers designed to bridge the gap between agricultural research and field implementation. Their broad mandate includes providing practical capacity-building programs for active farming communities, empowering rural youth through self-employment skill development, and updating front-line field extension personnel on modern technological advancements across agriculture and allied rural development sectors.

22. (A) Statement I is correct, but Statement II is incorrect.
The mKisan portal enables government agricultural experts to broadcast customized advisory text messages in regional languages to farmers across India. Because messages are transmitted via standard text messaging, farmers do not require expensive smartphones or high-speed internet connections. Basic feature phones are entirely sufficient to receive these crucial, time-sensitive agricultural and weather advisories effectively.

23. (B) Farm Schools conduct practical learning in crop fields across the growing season
Unlike conventional classroom setups that emphasize theoretical lectures, Farm Schools emphasize practical, discovery-based learning directly within real crop fields throughout the cultivation season. Participatory field activities, continuous crop observation, and localized problem-solving allow farmers to master best practices through firsthand experience under actual agro-ecological conditions rather than relying solely on abstract instructional presentations.

24. (A) Analysis of situation → Objectives → Execution → Evaluation → Reconsideration
Program planning in agricultural extension follows a systematic, continuous cycle to ensure effective community development. The planning sequence begins with analyzing current field situations and needs, setting clear objectives based on identified problems, executing planned educational activities, evaluating achieved outcomes against targets, and finally reconsidering the program to modify and improve future operational extension interventions.

25. (B) I, II, and III only
Agricultural training focuses on human resource development by improving technical knowledge, developing practical farming skills, and modifying attitudes toward adopting innovative practices. Distributing monetary loans or agricultural credit is a financial banking activity managed by credit institutions, falling completely outside the educational, capacity-building scope and primary functions of extension training programs.

26. (A) Campaign
A campaign is an intensive, time-bound extension method designed to mobilize resources

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(C) Method demonstration
(D) Farm visit

80. The principle of "local leadership" in agricultural extension implies that:
(A) Extension officers ought to assume active political leadership roles in rural villages
(B) Technology adoption is strictly restricted to elected village Sarpanches and officials
(C) Extension programs succeed by engaging key local leaders in planning and execution
(D) Local community leaders must personally fund all extension events and demonstrations

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35. (A) Benchmark existing participant skills and knowledge prior to instruction
Pre-training evaluation assesses the baseline knowledge, existing skills, and baseline competencies of participants prior to starting an educational program. Establishing this initial benchmark enables trainers to tailor instructional content to match actual learner requirements, avoid repeating familiar concepts, and measure precise knowledge gains by comparing pre-test data against post-training assessment outcomes.

36. (C) Agriculture Skill Council of India (ASCI)
The Agriculture Skill Council of India is the dedicated sector skill council responsible for developing national occupational standards, designing vocational training frameworks, and certifying skilled manpower across agriculture and allied sectors. Operating under the National Skill Qualification Framework, it enhances workforce productivity and rural employability by aligning vocational training with standardized industry requirements.

37. (A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
Front Line Demonstrations are organized directly by agricultural scientists and extension experts on farmers' fields to showcase the maximum yield potential and economic viability of newly released technologies. By conducting these field trials under actual farming conditions, researchers generate direct feedback, demonstrate practical superiority over local practices, and accelerate widespread adoption through reliable field data.

38. (D) Puppetry
Puppetry is a traditional folk media and audio-visual art form deeply rooted in rural Indian culture. By combining colorful visual movement, music, dramatic storytelling, and localized dialogue, it effectively captures community attention. It serves as an impactful non-formal tool for conveying social messages, agricultural innovations, and rural development concepts to diverse rural audiences effectively.

39. (A) Source → Message → Channel → Receiver
David Berlo's classical SMCR communication model outlines the essential flow of information through four core components arranged in strict logical order. Communication begins with the Source who encodes the idea, followed by the Message containing information, conveyed through an appropriate Channel or sensory medium, and ultimately interpreted by the intended Receiver at the end of the process.

40. (C) Fixing the Fair and Remunerative Price (FRP) of sugarcane
Training Needs Assessment aims to identify knowledge gaps, skill deficiencies, and learning requirements among farmers and extension staff to design effective educational curricula. Determining statutory commodity prices, such as the Fair and Remunerative Price for sugarcane, is a regulatory economic decision made by government authorities, completely separate from educational assessment methodologies.

41. (D) Method demonstration
Method demonstrations focus explicitly on teaching operational techniques, physical procedures, and hands-on skills, directly answering the core question of how to do a specific task. By observing a step-by-step physical demonstration performed by an expert, learners acquire practical mechanics and technical confidence required to carry out agricultural operations correctly on their own fields.

42. (A) Result demonstration
A result demonstration directly addresses the question of what the worth or value of a new agricultural practice is relative to traditional methods. By establishing side-by-side comparative field plots across a full crop cycle, it provides clear, quantifiable visual proof of yield increases, economic profitability, and overall performance advantages of recommended practices.

43. (C) I, II, and IV
Farmer Field Schools emphasize season-long, discovery-based experiential learning conducted directly within crop fields. Utilizing Agro-Ecosystem Analysis, farmers regularly observe crop ecosystems, analyze pest-predator relationships, and make informed field management decisions. Because these practical activities occur entirely in real farm environments, formal indoor university classroom lectures are excluded from this field-centered, participatory extension strategy.

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9. (D) 1800-180-1551
The Government of India established the Kisan Call Centre network to deliver immediate agricultural advisory services to farming communities across the country. Operating via the dedicated toll-free telephone number 1800-180-1551, this initiative provides real-time expert guidance in multiple regional languages regarding crop management, pest control, weather updates, and agricultural market prices directly to farmers.

10. (A) Existing knowledge/skills and required field performance levels
Training Needs Assessment is a systematic process used to identify the gap between current knowledge, skills, and attitudes of trainees and the required standard performance levels necessary for efficient operational task completion. Identifying these competency deficits allows extension organizations to design targeted, effective educational programs that address specific technical deficiencies among farming communities or extension staff.

11. (B) Kisan Goshthi (Farmers' Meeting)
Kisan Goshthis are structured meetings designed for interactive discussion among a medium-sized group of farmers, placing them firmly under group contact extension methods. In contrast, large-scale exhibitions, regional multi-day Kisan Melas, and published newspaper articles reach vast, heterogeneous populations simultaneously, making them classic examples of mass contact approaches rather than face-to-face group interaction methods.

12. (B) I, III, and IV
Extension education rests on fundamental principles such as adapting to cultural differences, facilitating learning by doing through practical execution, and developing local leadership for sustainable community development. Operational coercion or top-down administrative forcing contradicts the core philosophy of democratic extension, which relies strictly on voluntary participation, non-formal education, and democratic community empowerment to achieve sustainable agricultural progress.

13. (A) Edgar Dale
Edgar Dale introduced the Cone of Experience model in 1946 to categorize audio-visual aids based on their degree of directness and abstraction. The model places direct, purposeful experiences at the concrete base, progressing upward toward abstract symbolic representations. It illustrates that retention and learning efficiency increase significantly when instructional strategies involve hands-on, multi-sensory, and real-life experiential participatory learning activities.

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14. (A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
Farm Schools established under the Agricultural Technology Management Agency scheme serve as operational field centers for practical grassroots instruction. Positioned on the farms of progressive farmers, these centers facilitate peer-to-peer knowledge transfer, allowing neighboring farmers to observe and learn successful agricultural technologies throughout the crop growing season directly from their peers within local environmental conditions.

15. (D) Radio
Radio is a purely auditory medium that relies exclusively on sound waves, speech, and sound effects to transmit instructional and news content to listeners without visual elements. Conversely, television, cinema, and puppet performances combine both visual imagery and audio components simultaneously, categorizing them strictly as audio-visual tools rather than simple mono-medium audio instructional devices.

16. (C) To display modern agricultural technologies, tools, and inputs to the public
Agricultural exhibitions or fairs are large-scale mass contact extension events designed to present advanced farm machinery, high-yielding crop varieties, plant protection chemicals, and improved practices to a wide audience. They generate broad awareness, spark interest, and foster adoption by visually demonstrating scientific technological innovations and agricultural solutions to visiting farming communities within a single organized venue.

17. (B) Method demonstration
Teaching complex practical skills requires hands-on step-by-step instruction where learners observe precise physical operations and practice under supervision. A method demonstration excels at teaching such skills, like operating specialized machinery, because it directly demonstrates the operational sequence. Mass media tools like printed circular letters or radio talks lack

to large crowds. Preserved plant specimens, illustrated flashcards, and flannel graphs present information directly through sight without sound, placing them firmly in the category of visual aids rather than public acoustic amplification hardware.

54. (D) Result demonstration
Overcoming deep-rooted skepticism and negative attitudes toward new crop varieties requires convincing, tangible proof of superior field performance. A result demonstration provides direct visual evidence by comparing new varieties against traditional ones under real local field conditions across an entire growing season, proving profitability and yield advantages to turn hesitant farmers into confident adopters.

55. (B) Bulletin
In extension literature, a bulletin is a comprehensive printed publication usually comprising 24 to 48 pages that provides detailed, exhaustive coverage on a specific subject, such as package of practices for a major crop. It offers far more thorough technical analysis and instructional guidance than brief single-sheet items like leaflets, folders, or circular letters.

56. (C) It merges sound with images to instruct diverse literate and illiterate rural audiences
Television serves as an exceptionally powerful mass medium because it integrates moving visual images with synchronized audio content. This dual sensory appeal enables extension agencies to convey complex agricultural advisories, pest control techniques, and field demonstrations clearly to diverse farming audiences, effectively reaching both literate and illiterate farmers simultaneously without geographical or educational limitations.

57. (A) Statement I is correct, but Statement II is incorrect.
Social media platforms allow farmers and extension personnel to share immediate real-time updates and localized alerts regarding pest outbreaks rapidly and economically. However, user-generated online content is not inherently validated by scientists, creating significant risks of circulating unverified information, rumors, or incorrect crop management recommendations among farming communities without proper technical verification.

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58. (A) Role play
Role play is an interactive training technique where participants spontaneously act out real-life operational or interpersonal situations without scripts. By stepping into different roles, trainees gain deep insights into human behavior, practice communication strategies, and explore creative problem-solving techniques in a safe learning environment, making it ideal for developing leadership and extension interpersonal skills.

59. (B) Demonstration
The demonstration approach in extension education unites two fundamental instructional principles: learning by doing and seeing is believing. Method demonstrations provide practical hands-on experience through active execution, fulfilling learning by doing. Result demonstrations display tangible comparative field outcomes, fulfilling seeing is believing. Together, these complementary techniques form a highly effective strategy for agricultural technology transfer.

60. (B) Instruction occurs in dedicated facilities outside actual farm environments
Off-farm training is defined by conducting educational programs within specialized institutional facilities, such as KVK classrooms, university auditoriums, or training centers located away from working farm fields. This environment minimizes field distractions, provides access to audio-visual infrastructure, and allows structured theoretical instruction, formal group discussions, and systematic skill building for participating trainees.

61. (A) Provide an organized forum for rural peer learning and resource sharing
Kisan Mandals or Farmers' Clubs are voluntary village-level grassroots organizations designed to foster mutual support, peer-to-peer learning, and collective action among local farmers. They provide a structured forum where members share agricultural experiences, access scientific extension advisory services, adopt innovative technologies collectively, and build community self-reliance without engaging in partisan political activities or administrative law enforcement.

62. (C) Non-projected visual aid
A chalkboard or whiteboard is a classical display surface used to present written text, diagrams, and drawings directly to a learning group.

if the farmer repays the loan promptly within one year?
(A) 7 percent
(B) 5 percent
(C) 4 percent
(D) 0 percent

26. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R):
Assertion (A): The e-NAM platform improves price realization for farmers selling their produce.
Reason (R): It integrates physical APMC mandis on a virtual platform, increasing the number of participating buyers and eliminating information asymmetry.
(A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
(B) Both Assertion (A) and Reason (R) are true but R is not the correct explanation of A.
(C) Assertion (A) is true but Reason (R) is false.
(D) Assertion (A) is false but Reason (R) is true.

27. The Rashtriya Krishi Vikas Yojana (RKVY) was revamped as RKVY-RAFTAAR. What does the core component of "RAFTAAR" aim to promote in the agricultural sector?
(A) Agri-entrepreneurship and agribusiness incubation
(B) Rapid farm mechanization and technology adoption for small landholdings
(C) Rapid distribution and balanced utilization of chemical fertilizers
(D) Fast-track construction and structural maintenance of rural unpaved roads

28. Consider the following statements regarding the Pradhan Mantri Awas Yojana - Gramin (PMAY-G):
I. The cost of unit assistance is shared between Central and State Governments in the ratio of 60:40 in plain areas.
II. In North-Eastern and Himalayan States, the cost-sharing ratio is 90:10.
III. Funds are directly transferred to the bank accounts of beneficiaries.
IV. The scheme only provides loans and does not provide direct financial grants.
Which of the above statement(s) is/are INCORRECT?
(A) I and II only
(B) III only
(C) IV only
(D) II and IV only

29. Which of the following is NOT an objective of the Pradhan Mantri Krishi Sinchayee Yojana (PMKSY)?
(A) Convergence of investments in irrigation at the field level (Har Khet Ko Pani)
(B) Enhancing the adoption of precision-irrigation and other water-saving technologies (Per Drop More Crop)
(C) Enhancing recharge of aquifers and introducing sustainable water conservation practices
(D) Providing free electricity for drawing groundwater in all states

30. For the formation of a Farmer Producer Organization (FPO) in plain areas under the Central Sector Scheme for 10,000 FPOs, what is the minimum farmer-member requirement?
(A) 50 members
(B) 100 members
(C) 300 members
(D) 500 members

31. Match List I with List II:
List I: (Scheme)
P. Mahatma Gandhi NREGA
Q. Pradhan Mantri Fasal Bima Yojana
R. Jal Jeevan Mission
S. Pradhan Mantri Kaushal Vikas Yojana
List II: (Nodal Implementing Ministry)
1. Ministry of Agriculture and Farmers Welfare
2. Ministry of Rural Development
3. Ministry of Jal Shakti
4. Ministry of Skill Development and Entrepreneurship
(A) P-2, Q-1, R-3, S-4
(B) P-1, Q-2, R-4, S-3
(C) P-3, Q-4, R-1, S-2
(D) P-2, Q-3, R-1, S-4

32. Under the Pradhan Mantri Fasal Bima Yojana (PMFBY), if a sugarcane crop is insured as an annual commercial crop, what is the maximum premium percentage of the sum insured payable by the farmer?
(A) 1.5 percent
(B) 2.0 percent
(C) 5.0 percent
(D) 8.0 percent

33. Given below are two statements regarding the PM-KISAN scheme:
Statement I: Institutional landholders are excluded from receiving benefits under the PM-

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Maintaining a group size of 10 to 15 members balances interactive participation with structured moderation, preventing dominant individuals from overshadowing quieter participants and avoiding audience fragmentation.

72. (C) Defining explicit evaluation objectives and performance indicators
Evaluating a training program systematically begins with establishing precise evaluation objectives and measurable performance indicators. Defining clear evaluation goals upfront determines what specific learning outcomes, behavioral changes, or knowledge gains need to be measured, providing the necessary foundation for selecting appropriate data collection instruments, structuring assessment questionnaires, and analyzing operational outcome data accurately.

73. (D) Applying internet, ICT tools, and digital networks to agricultural extension
Cyber extension refers to integrating Information and Communication Technologies, internet networks, digital applications, and modern software platforms into traditional agricultural extension frameworks. It facilitates rapid, widespread, and interactive dissemination of expert agricultural advisories, market price intelligence, weather forecasts, and scientific technical knowledge directly to farmers and extension workers across geographically dispersed regions.

74. (D) Reaction (Participant satisfaction feedback on training experience)
Donald Kirkpatrick's four-level training evaluation model begins at Level 1 by measuring participant Reaction. This initial level assesses how trainees felt about the educational experience, including their satisfaction with instructional delivery, venue facilities, material relevance, and overall presentation. Subsequent levels systematically measure acquired Learning at Level 2, job Behavior changes at Level 3, and final organizational Results at Level 4.

75. (B) They excel at teaching complex, hands-on practical skills to individuals.
Mass contact extension methods focus on reaching large numbers of people rapidly to create widespread preliminary awareness. However, because they lack one-on-one personal contact, immediate feedback, and practical supervision, mass methods cannot effectively teach complex, multi-step practical skills that require individualized hands-on execution, physical demonstration, and personalized instruction under actual field working conditions.

76. (B) Individual contact method
A Farm Clinic operates as a specialized diagnostic facility where individual farmers bring specific field problems, diseased plant specimens, or pest samples directly to extension specialists for expert diagnosis and customized advisory. Because consultations focus on specific individual farm issues through direct one-on-one interaction, the approach functions fundamentally as an individual contact extension method.

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77. (A) Opaque projector (Epidiascope)
An opaque projector, or epidiascope, uses optical lenses and strong light sources to project magnified visual images of non-transparent physical materials, printed pages, or real flat objects onto a screen. This hardware capability classifies it directly as a projected visual aid, distinguishing it from non-projected display tools like flannel boards, physical specimens, or handheld flashcards.

78. (C) Imparting certifiable vocational skills to rural youth to boost employability
Under the Skill India framework, agricultural vocational initiatives focus on delivering standardized, competency-based skill training to rural youth, farm laborers, and prospective agricultural entrepreneurs. By offering formal certification across specialized trades like micro-irrigation, seed production, and tractor operation, these programs enhance rural employment opportunities, promote self-employment, and build a skilled workforce for modern agricultural operations.

79. (D) Farm visit
A farm visit occurs when an extension agent travels directly to a specific farmer's field to observe crop conditions, diagnose pest or disease damage, and provide personalized advisory. This face-to-face individual contact allows site-specific problem solving, builds mutual trust between extension personnel and farmers, and delivers tailored practical guidance suited to the unique field situation.

8. Which of the following parameters is NOT tested and included in the 12 standard parameters of a Soil Health Card?
(A) Molybdenum (Mo)
(B) Nitrogen (N)
(C) Boron (B)
(D) Electrical Conductivity (EC)

9. Under the Paramparagat Krishi Vikas Yojana (PKVY), organic farming is promoted through the adoption of an organic village by cluster approach. What is the minimum standard cluster size generally required under this scheme?
(A) 10 acres
(B) 20 acres
(C) 50 acres
(D) 100 acres

10. Which of the following represents the correct sequential workflow for the operationalization of the Soil Health Card scheme at the field level?
(A) Soil sampling → Soil testing in laboratory → Uploading data on web portal → Generation of Soil Health Card
(B) Soil sampling → Uploading data on web portal → Soil testing in laboratory → Generation of Soil Health Card
(C) Generation of Soil Health Card → Soil sampling → Soil testing in laboratory → Uploading data on web portal
(D) Uploading data on web portal → Soil sampling → Generation of Soil Health Card → Soil testing in laboratory

11. What is the maximum financial assistance provided to the eligible family of a farmer in case of accidental death or 100 percent permanent disability under the Mukhyamantri Krishak Durghatna Kalyan Yojana of Uttar Pradesh?
(A) Rs. 2,000,000
(B) Rs. 3,000,000
(C) Rs. 5,000,000
(D) Rs. 10,000,000

12. Which of the following agencies is the lead implementing agency for the National Agriculture Market (e-NAM) under the aegis of the Ministry of Agriculture and Farmers Welfare?
(A) Food Corporation of India (FCI)
(B) National Cooperative Development Corporation (NCDC)
(C) Small Farmers Agribusiness Consortium (SFAC)
(D) National Bank for Agriculture and Rural Development (NABARD)

13. What is the minimum prescribed built-up area for a house constructed under the Pradhan Mantri Awas Yojana - Gramin (PMAY-G), excluding the toilet?
(A) 20 square meters
(B) 25 square meters
(C) 30 square meters
(D) 35 square meters

14. Consider the following statements regarding the ERP system and E-Ganna App launched for sugarcane farmers in Uttar Pradesh:
I. It ensures transparency in the issuance of cane supply slips (purchi) to farmers.
II. It eliminates the role of middlemen and cane mafias in the cane supply process.
III. Farmers can access their cane calendar, supply tickets, and weighment details online.
IV. The system charges a mandatory subscription fee of Rs. 500 per farmer annually.
Which of the above statement(s) is/are correct?
(A) I, II and III only
(B) II, III and IV only
(C) I, III and IV only
(D) I, II, III and IV

15. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R):
Assertion (A): Micro-irrigation systems such as drip irrigation significantly reduce weed growth in crop fields.
Reason (R): Drip irrigation delivers water directly to the root zone of the crop, leaving the inter-row spaces dry and unfavorable for weed seed germination.
(A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
(B) Both Assertion (A) and Reason (R) are true but R is not the correct explanation of A.
(C) Assertion (A) is true but Reason (R) is false.
(D) Assertion (A) is false but Reason (R) is true.

16. Under the Sub-Mission on Agricultural Mechanization (SMAM), what is the standard rate of subsidy provided to General Category farmers for the purchase of standard agricultural equipment like tractors and rotavators?
(A) 25 to 30 percent
(B) 40 to 50 percent
(C) 60 to 70 percent
(D) 80 to 90 percent

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CHAPTER 21

Government Rural Development and Farmer Welfare Schemes

1. Under the Pradhan Mantri Kisan Samman Nidhi (PM-KISAN) scheme, what is the total amount of income support provided annually to eligible farmer families?
(A) Rs. 4,000 payable in two equal installments
(B) Rs. 6,000 payable in three equal installments
(C) Rs. 8,000 payable in four equal installments
(D) Rs. 10,000 payable in two equal installments

2. What is the guaranteed number of days of wage employment provided in a financial year to a rural household whose adult members volunteer to do unskilled manual work under the Mahatma Gandhi NREGA scheme?
(A) 50 days
(B) 100 days
(C) 150 days
(D) 200 days

3. Match List I with List II:
List I: (Scheme)
P. Pradhan Mantri Fasal Bima Yojana (PMFBY)
Q. Kisan Credit Card (KCC) Scheme
R. Soil Health Card (SHC) Scheme
S. Pradhan Mantri Kisan Samman Nidhi (PM-KISAN)
List II: (Year of Launch)
1. 1998
2. 2015
3. 2016
4. 2019
(A) P-3, Q-1, R-2, S-4
(B) P-1, Q-3, R-4, S-2
(C) P-2, Q-4, R-1, S-3
(D) P-3, Q-2, R-1, S-4

4. Under the Pradhan Mantri Gram Sadak Yojana (PMGSY), what is the minimum eligible population size for connecting unconnected habitations in plain areas?
(A) 250 persons
(B) 500 persons
(C) 1000 persons
(D) 1500 persons

5. Consider the following statements regarding the premium rates paid by farmers under the Pradhan Mantri Fasal Bima Yojana (PMFBY):
I. The premium for all Kharif crops is fixed at 2 percent.
II. The premium for all Rabi crops is fixed at 1.5 percent.
III. The premium for annual commercial and horticultural crops is fixed at 5 percent.
Which of the above statement(s) is/are correct?
(A) I and II only
(B) II and III only
(C) I and III only
(D) I, II and III

6. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R):
Assertion (A): The Soil Health Card scheme aims to promote the balanced use of fertilizers in agricultural fields.
Reason (R): Soil Health Cards provide crop-wise recommendations of nutrients and fertilizers required for individual farms to improve soil fertility and yield.
(A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
(B) Both Assertion (A) and Reason (R) are true but R is not the correct explanation of A.
(C) Assertion (A) is true but Reason (R) is false.
(D) Assertion (A) is false but Reason (R) is true.

7. What is the effective rate of interest on a short-term crop loan of up to Rs. 3 lakh under the Kisan Credit Card (KCC) scheme if the farmer makes prompt and timely repayments?
(A) 7 percent
(B) 5 percent
(C) 4 percent
(D) 3 percent

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and encourage bank borrowing
(B) To purchase heavy agricultural machinery and modern equipment like combine harvesters for all members
(C) To permanently clear all existing informal and private loans of individual group members in full
(D) To distribute regular monthly financial stipends and salaries to designated office bearers of the SHG

41. Consider the following statements regarding the eligibility for the Mukhyamantri Krishak Durghatna Kalyan Yojana in Uttar Pradesh:
I. It covers farmers holding agricultural land in their own name in the state revenue records.
II. Co-sharers (saha-khatedar) of the agricultural land are also recognized as eligible beneficiaries.
III. Landless persons working on the agricultural land of other farmers who derive their main livelihood from agriculture are strictly excluded.
Which of the above statement(s) is/are correct?
(A) I and II only
(B) II and III only
(C) I and III only
(D) I, II and III

42. Under the promotion of agricultural mechanization, Custom Hiring Centres (CHCs) are established primarily to:
(A) Sell subsidized high-yield chemical fertilizers and soil conditioners directly to local farmers
(B) Rent farm machinery and implements to small and marginal farmers
(C) Purchase harvested food crops directly from farmers at guaranteed state minimum support prices
(D) Provide comprehensive soil testing and analytical laboratory facilities to farmers on a daily basis

43. Which of the following groups of farmers is fully ELIGIBLE to receive financial benefits under the PM-KISAN scheme?
(A) Marginal farmers holding less than 1 hectare of cultivable land
(B) Farmers who paid income tax in the last assessment year
(C) Farmers who are currently serving as doctors in government hospitals
(D) Former Members of Parliament (MPs) possessing agricultural land

44. Identify the CORRECT pair from the rural development schemes and their key focus area:
(A) Deendayal Antyodaya Yojana - Constructing modern rural sports infrastructure
(B) Pradhan Mantri Gram Sadak Yojana - Upgrading district hospitals and healthcare centres
(C) Pradhan Mantri Awas Yojana (Gramin) - Construction of pucca houses
(D) Paramparagat Krishi Vikas Yojana - Distributing subsidized tractors to farm clusters

45. What is the funding pattern between the Central Government and the State Government of Uttar Pradesh for the implementation of the DAY-NRLM scheme?
(A) 100:0 (Fully Centrally Sponsored)
(B) 90:10 (Centre:State)
(C) 60:40 (Centre:State)
(D) 50:50 (Centre:State)

46. Given below are two statements regarding the Jal Jeevan Mission:
Statement I: The mission aims to supply 55 liters of water per capita per day (lpcd) to every rural household.
Statement II: The water is to be supplied exclusively through functional household tap connections (FHTC).
(A) Both Statement I and Statement II are correct
(B) Both Statement I and Statement II are incorrect
(C) Statement I is correct, but Statement II is incorrect
(D) Statement I is incorrect, but Statement II is correct

47. To improve agricultural infrastructure at the farm gate and aggregation points, the Government of India launched the Agriculture Infrastructure Fund (AIF). What is the total financing facility size of this fund?
(A) Rs. 10,000 crore
(B) Rs. 50,000 crore
(C) Rs. 1 lakh crore
(D) Rs. 5 lakh crore

48. In the context of cane development in Uttar Pradesh, the state government has simplified the licensing system by making it completely online for which traditional rural sugar manufacturing units?

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17. The Government of India launched a Central Sector Scheme for the formation and promotion of 10,000 Farmer Producer Organizations (FPOs). Which of the following is NOT one of the primary implementing agencies for this scheme?
(A) Indian Council of Agricultural Research (ICAR)
(B) Small Farmers Agribusiness Consortium (SFAC)
(C) National Bank for Agriculture and Rural Development (NABARD)
(D) National Cooperative Development Corporation (NCDC)

18. Under the Deendayal Antyodaya Yojana - National Rural Livelihoods Mission (DAY-NRLM), a Self Help Group (SHG) is generally defined as an informal group of poor women with what typical membership size?
(A) 5 to 10 members
(B) 10 to 20 members
(C) 25 to 35 members
(D) 40 to 50 members

19. The Jal Jeevan Mission, a major rural sanitation and water supply scheme, aims to provide safe and adequate drinking water through individual household tap connections to all rural households in India by which target year?
(A) 2023
(B) 2024
(C) 2025
(D) 2030

20. Match List I with List II:
List I: (Scheme)
P. PMKSY (Per Drop More Crop)
Q. e-NAM
R. PKVY
S. RKVY
List II: (Core Objective)
1. Promotion of organic farming
2. State autonomy in agricultural planning and investment
3. Micro-irrigation and water use efficiency
4. Unified national market for agricultural commodities
(A) P-3, Q-4, R-1, S-2
(B) P-4, Q-3, R-2, S-1
(C) P-3, Q-1, R-4, S-2
(D) P-1, Q-4, R-3, S-2

21. Consider the following statements regarding the expansion of the Kisan Credit Card (KCC) scheme facilities:
I. The KCC facility has been extended to animal husbandry farmers.
II. The KCC facility has been extended to fisheries farmers.
III. The maximum limit for collateral-free agriculture loans has been reduced to Rs. 50,000.
Which of the above statement(s) is/are correct?
(A) I and II only
(B) II and III only
(C) I and III only
(D) I, II and III

22. What is the prescribed age limit for a farmer or their eligible family member to qualify for compensation under the Mukhyamantri Krishak Durghatna Kalyan Yojana in Uttar Pradesh?
(A) 18 to 60 years
(B) 18 to 70 years
(C) 21 to 65 years
(D) 21 to 75 years

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23. Arrange the following standard operational stages of the National Agriculture Market (e-NAM) process in the correct sequential order:
1. e-Bidding by traders
2. Gate Entry of the agricultural produce
3. e-Payment and Weighing
4. Assaying (Quality testing)
Choose the correct order:
(A) 2, 4, 1, 3
(B) 2, 1, 4, 3
(C) 4, 2, 1, 3
(D) 1, 4, 2, 3

24. Which of the following programs under the Digital India initiative aims specifically to computerize rural land records and ensure title guarantees to farmers?
(A) Digital India Land Records Modernization Programme (DILRMP)
(B) e-Panchayat Mission Mode Project
(C) Common Service Centre (CSC) Scheme
(D) Pradhan Mantri Gramin Digital Saksharta Abhiyan (PMGDISHA)

25. If a sugarcane farmer takes a crop loan of Rs. 1,000,000 under the Kisan Credit Card (KCC) scheme at the base interest rate of 7 percent, what will be the effective interest rate applicable

80. (C) Extension programs succeed by engaging key local leaders in planning and execution

The principle of local leadership emphasizes identifying, training, and engaging respected community leaders to drive extension activities. Local leaders hold informal influence and trust within their villages. By involving them in program planning and execution, extension agencies gain community acceptance, bridge communication gaps between scientists and farmers, and ensure sustainable technology adoption throughout local rural communities.

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KISAN scheme.
Statement II: All serving or retired officers of the Central/State Government Ministries and regular employees of local bodies (excluding Class IV/Group D employees) are excluded from the scheme.
(A) Both Statement I and Statement II are correct
(B) Both Statement I and Statement II are incorrect
(C) Statement I is correct, but Statement II is incorrect
(D) Statement I is incorrect, but Statement II is correct

34. Consider the following statements regarding wage payment rules under the Mahatma Gandhi NREGA:
I. Wages must be paid within 15 days of the closure of the muster roll.
II. If work is not provided within 15 days of receiving the application, a daily unemployment allowance must be paid to the applicant.
III. Equal wages must be paid to men and women workers.
Which of the above statement(s) is/are correct?
(A) I and II only
(B) II and III only
(C) I and III only
(D) I, II and III

35. Which of the following represents the correct sequential flow of a farmer's produce moving up the value chain through formal agricultural schemes?
(A) Availing seed/fertilizer via KCC → Pooling produce into an FPO → Quality testing (Assaying) → Online sale via e-NAM
(B) Online sale via e-NAM → Availing seed/fertilizer via KCC → Pooling produce into an FPO → Quality testing (Assaying)
(C) Pooling produce into an FPO → Online sale via e-NAM → Quality testing (Assaying) → Availing seed/fertilizer via KCC
(D) Quality testing (Assaying) → Pooling produce into an FPO → Availing seed/fertilizer via KCC → Online sale via e-NAM

36. Which dedicated toll-free helpline number has been established by the Uttar Pradesh Cane Development Department to assist sugarcane farmers with their queries related to the cane calendar and weighment slips?
(A) 1800-180-1551
(B) 1800-121-3203
(C) 1800-111-2222
(D) 1800-150-1000

37. To provide financial assistance to states for expanding coverage of micro-irrigation under PMKSY, a dedicated Micro Irrigation Fund (MIF) has been created with which of the following financial institutions?
(A) Reserve Bank of India (RBI)
(B) National Bank for Agriculture and Rural Development (NABARD)
(C) State Bank of India (SBI)
(D) Asian Development Bank (ADB)

38. Consider the following statements regarding the Paramparagat Krishi Vikas Yojana (PKVY):
I. It is an extended component of the Soil Health Management scheme.
II. It exclusively promotes the use of genetically modified (GM) seeds for higher yields.
III. Financial assistance of Rs. 50,000 per hectare is provided for a period of three years.
IV. Organic certification is done through the Participatory Guarantee System (PGS-India).
Which of the above statement(s) is/are correct?
(A) I, II and III only
(B) II, III and IV only
(C) I, III and IV only
(D) I, II, III and IV

39. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R):
Assertion (A): The promotion of Farmer Producer Organizations (FPOs) enhances the bargaining power of small and marginal farmers.
Reason (R): FPOs aggregate the agricultural inputs and outputs of their members, achieving economies of scale and reducing transaction costs.
(A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
(B) Both Assertion (A) and Reason (R) are true but R is not the correct explanation of A.
(C) Assertion (A) is true but Reason (R) is false.
(D) Assertion (A) is false but Reason (R) is true.

40. Under the DAY-NRLM scheme, what is the primary purpose of providing a "Revolving Fund" to a Self Help Group (SHG)?
(A) To meet immediate credit needs of members

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Because it displays visual information directly without utilizing optical projection hardware, light sources, or electronic projection systems, it is classified strictly as a non-projected visual aid in traditional extension teaching methodologies.

63. (D) Defining clear learning objectives and analyzing target audience requirements
Developing effective extension teaching materials begins with systematically defining target learning objectives and assessing the specific needs, literacy levels, and background knowledge of the audience. Establishing clear instructional goals and understanding learner characteristics ensures that subsequent content creation, design choices, language translation, and media distribution remain relevant, impactful, and pedagogically sound for rural communities.

64. (C) Principle of autocratic command leadership
Agricultural extension operates on democratic, non-formal educational principles that emphasize voluntary participation, cultural adaptation, community empowerment, and local leadership development. Autocratic command leadership contradicts the core philosophy of extension, which relies on mutual trust, participatory decision-making, and cooperative engagement rather than top-down authority or forced compliance when driving sustainable rural development practices.

65. (B) Campaign
A campaign is an intensive, well-organized extension drive conducted over a specified timeframe to achieve rapid, widespread adoption of a single urgent practice across a community. By concentrating promotional media, group meetings, and field demonstrations on a singular objective, campaigns mobilize public action quickly to resolve pressing issues like widespread pest outbreaks or seasonal field operations.

66. (D) Method demonstration
When an extension worker physically demonstrates the precise mechanical steps involved in executing a task, such as cutting and preparing three-budded sugarcane setts, the technique used is a method demonstration. This approach teaches physical skills directly through visual observation and guided practice, allowing farmers to master correct task execution procedures systematically during instructional sessions.

67. (A) Improving knowledge, skills, and capabilities of farm stakeholders
Capacity building in agricultural extension refers to human resource development aimed at enhancing the knowledge, practical skills, attitudes, and operational competencies of farmers, extension agents, and rural organizations. Strengthening these human capacities empowers individuals and communities to solve problems independently, adapt to emerging technologies, manage agricultural enterprises efficiently, and achieve long-term socio-economic sustainability.

68. (C) Radio broadcast
Standard radio broadcasts represent a mass communication medium that transmits audio signals from a central studio to broad public audiences. Because listeners cannot immediately respond or interact directly with the broadcast presenter during a standard transmission, it represents a classic one-way communication channel characterized by delayed, limited, or completely absent real-time listener feedback mechanisms.

69. (B) Statement I is incorrect, but Statement II is correct.
Audio-visual aids function as supplemental tools designed to enhance learning, clarify complex concepts, and retain audience attention, rather than replacing the extension worker. By translating abstract scientific concepts into concrete visual and auditory representations, these tools assist extension personnel in delivering clear, engaging, and memorable educational presentations that significantly improve farmer comprehension and technology adoption.

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70. (D) World Bank
The Training and Visit system of agricultural extension was developed by Daniel Benor and systematically implemented across various Indian states during the 1970s with major financial and technical support from the World Bank. The system emphasized strict operational schedules, professional training for field agents, regular fixed farm visits, and continuous research-extension-farmer linkages to boost crop productivity.

71. (B) 10 to 15
Effective group discussions require a group size that is small enough to ensure every participant can contribute actively, yet large enough to provide diverse perspectives and ideas.

(A) Commercial biscuit manufacturing factories
(B) Industrial synthetic sugar production units
(C) Commercial bakery and confectionery units
(D) Khandsari and Gur units

49. Which of the following statements correctly describes the focus of Phase-III of the Pradhan Mantri Gram Sadak Yojana (PMGSY)?
(A) Connecting habitations to Gramin Agricultural Markets, higher secondary schools, and hospitals
(B) Providing initial all-weather road connectivity to unconnected rural habitations across all plain areas
(C) Constructing multi-lane national highways and expressways linking major state capitals and commercial hubs
(D) Exclusively constructing paved dirt tracks and field access roads inside private agricultural farms

50. Under the DAY-NRLM scheme, what does the term VPRP stand for, which is a micro-plan prepared by SHG networks to demand their rights and entitlements?
(A) Voluntary Public Rights Plan
(B) Village Population Registration Plan
(C) Village Poverty Reduction Plan
(D) Verified Payment Release Program

51. Match List I with List II:
List I: (Abbreviation)
P. e-NAM
Q. CHC
R. FPO
S. SHG
List II: (Field of Application)
1. Farm Mechanization Rental
2. Collective agricultural marketing and input purchasing
3. Micro-credit and women empowerment
4. Digital Mandi Trading
(A) P-4, Q-1, R-2, S-3
(B) P-1, Q-4, R-3, S-2
(C) P-4, Q-2, R-1, S-3
(D) P-2, Q-3, R-4, S-1

52. If a sugarcane farmer from Saharanpur district, Uttar Pradesh, is a registered and eligible beneficiary under the PM-KISAN scheme, what amount will be credited to his bank account in a single regular installment?
(A) Rs. 1,000
(B) Rs. 2,000
(C) Rs. 4,000
(D) Rs. 6,000

53. Under the Skill India Mission, the Deen Dayal Upadhyaya Grameen Kaushalya Yojana (DDU-GKY) targets rural youth for skill development. What is the standard age group targeted under this scheme?
(A) 10 to 20 years
(B) 15 to 35 years
(C) 25 to 45 years
(D) 35 to 55 years

54. Identify the CORRECT pair regarding the implementing agencies or partners of major government schemes:
(A) KCC Scheme - Reserve Bank of India strictly directly lending to farmers
(B) Soil Health Card - Central Board of Direct Taxes
(C) PMFBY - General Insurance Companies (e-panelled)
(D) MGNREGA - Indian Space Research Organisation

55. If a Soil Health Card recommends an application of 92 kg of elemental Nitrogen per hectare for a sugarcane crop, approximately how much Urea fertilizer (containing 46% Nitrogen) must the farmer apply to meet this requirement?
(A) 100 kg
(B) 150 kg
(C) 200 kg
(D) 400 kg

56. Given below are two statements regarding the Digital India initiative in rural areas:
Statement I: Common Service Centres (CSCs) act as access points for the delivery of essential public utility services, social welfare schemes, and agricultural services in villages.
Statement II: The e-Panchayat project aims to completely abolish the physical Gram Panchayat system and replace it with urban municipalities.
(A) Both Statement I and Statement II are correct
(B) Both Statement I and Statement II are incorrect
(C) Statement I is correct, but Statement II is incorrect
(D) Statement I is incorrect, but Statement II is correct

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Organizations establishes clear minimum membership requirements. For plain areas, an FPO must have a minimum membership of three hundred farmers, whereas in hilly and northeastern regions, the minimum baseline threshold is relaxed to one hundred farmer members.

31. (A) P-2, Q-1, R-3, S-4
Key social sector and rural schemes operate under designated nodal ministries. The Mahatma Gandhi NREGA is implemented by the Ministry of Rural Development, Pradhan Mantri Fasal Bima Yojana by the Ministry of Agriculture, Jal Jeevan Mission by the Ministry of Jal Shakti, and Pradhan Mantri Kaushal Vikas Yojana by Skill Development.

32. (C) 5.0 percent
The Pradhan Mantri Fasal Bima Yojana caps the maximum insurance premium payable by farmer beneficiaries to make risk coverage affordable. While food grains and oilseeds attract lower premium percentages for Kharif and Rabi seasons, annual commercial and horticultural crops, including sugarcane, carry a maximum fixed farmer premium share of five percent.

33. (A) Both Statement I and Statement II are correct
The PM-KISAN scheme incorporates specific exclusion criteria to direct financial benefits to genuine farming households. Institutional landholders are strictly ineligible for income support. Similarly, serving or retired government employees, along with professionals and high-income taxpayers, are excluded, though Group D and Class IV employees remain eligible to receive benefits.

34. (D) I, II and III
The Mahatma Gandhi NREGA enforces legal provisions to safeguard rural workers. Wages must be paid within fifteen days of muster roll closure. If work is not allotted within fifteen days of application, an unemployment allowance is legally payable. Additionally, the Act strictly mandates equal wage payments for male and female workers.

35. (A) Availing seed/fertilizer via KCC → Pooling produce into an FPO → Quality testing (Assaying) → Online sale via e-NAM
Agricultural value addition follows a progressive sequence. Farmers first procure inputs like seeds and fertilizers using credit from a Kisan Credit Card. After harvesting, produce is aggregated through a Farmer Producer Organization, subjected to quality assaying in testing labs, and ultimately listed for transparent competitive bidding on the e-NAM platform.

36. (B) 1800-121-3203
To assist sugarcane growers, the Cane Development Department of Uttar Pradesh operates a dedicated toll-free helpline number, 1800-121-3203. Farmers can call this number to resolve queries, address grievances, and obtain information regarding supply tickets, calendar entries, weighment slips, and general cane supply procedures without visiting government offices.

37. (B) National Bank for Agriculture and Rural Development (NABARD)
To encourage state investments in expanding micro-irrigation infrastructure under PMKSY, the Government of India created a dedicated Micro Irrigation Fund. This fund is established with the National Bank for Agriculture and Rural Development, enabling states to access concessional loan financing to meet matching funds and offer top-up subsidies.

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38. (C) I, III and IV only
Paramparagat Krishi Vikas Yojana promotes traditional organic practices under Soil Health Management by providing fifty thousand rupees per hectare over three years for inputs, marketing, and Participatory Guarantee System certification. Because organic farming strictly avoids genetically modified seeds and synthetic chemicals, the statement claiming exclusive promotion of GM seeds is incorrect.

39. (A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
Small and marginal farmers often face high transaction costs and low bargaining strength due to fragmented landholdings. Organizing them into Farmer Producer Organizations aggregates input purchases and harvested crops. This collective volume generates economies of scale, lowers transportation and input expenses,

bodies.

Statement II: The "Watershed Development" component focuses on effective rainfall management, runoff reduction, and soil moisture conservation.

(A) Both Statement I and Statement II are correct
(B) Both Statement I and Statement II are incorrect
(C) Statement I is correct, but Statement II is incorrect
(D) Statement I is incorrect, but Statement II is correct

66. In the context of farm mechanization schemes, what is a Custom Hiring Centre (CHC)?
(A) A subsidized facility established to purchase old, obsolete tractors and tools from farmers
(B) A centralized rural training workshop where local farmers are trained in handloom weaving
(C) A unit offering farm machinery and equipment for custom hiring by farmers
(D) A district government office that strictly issues commercial driving licenses for tractors

67. Which of the following implements is GENERALLY NOT subsidized for individual marginal farmers under basic farm mechanization schemes due to its massive cost and large-scale operational requirement?
(A) Self-Propelled Combine Harvester
(B) Manual or Battery-operated Knapsack Sprayer
(C) Tractor-drawn Seed-cum-Fertilizer Drill
(D) Heavy-duty Tractor-mounted Cultivator

68. The Jal Jeevan Mission relies heavily on community participation. Which grassroots institution is primarily responsible for planning, implementing, managing, and maintaining the in-village water supply infrastructure?
(A) District Rural Development Agency (DRDA) Executive Board
(B) State Water Resources and Sanitation Commission
(C) National Water Resources Development Agency Directorate
(D) Village Water and Sanitation Committee (VWSC)

69. Under the Rashtriya Krishi Vikas Yojana (RKVY), the State Level Sanctioning Committee (SLSC) has the authority to sanction specific agricultural projects for the state. Who officially chairs this SLSC in Uttar Pradesh?
(A) The Union Minister of Agriculture and Farmers Welfare
(B) The Chief Secretary of the State
(C) The District Magistrate and Collector
(D) The elected Village Panchayat Pradhan

70. What is the primary underlying principle and goal behind the inception of the Rashtriya Krishi Vikas Yojana (RKVY) in India?
(A) To completely shift all agricultural planning and funding from State Governments to the Central Government
(B) To permanently replace the existing Minimum Support Price (MSP) procurement system
(C) To incentivize States to increase public investment in agriculture and allied sectors
(D) To strictly ban the export of all primary agricultural commodities from Indian ports

71. Under the Agriculture Infrastructure Fund (AIF), what is the percentage of interest subvention provided on loans for building post-harvest management infrastructure, up to a limit of Rs. 2 crore?
(A) 1 percent per annum
(B) 2 percent per annum
(C) 3 percent per annum
(D) 5 percent per annum

72. Identify the CORRECT pair combining the initiative and its core functional description under the Skill India Mission in rural domains:
(A) PMKVY - Short-term skill training and certification
(B) Rozgar Mela - Direct distribution of subsidized chemical fertilizers and seeds
(C) Krishi Vigyan Kendra (KVK) - Financial assistance for construction of rural housing
(D) Skill India Digital Portal - Online registration for subsidized tractor loans

73. The Bharatiya Prakritik Krishi Paddhati (BPKP) is promoted as a sub-scheme under which major umbrella scheme of the Government of India?
(A) Pradhan Mantri Fasal Bima Yojana (PMFBY)
(B) Paramparagat Krishi Vikas Yojana (PKVY)
(C) Pradhan Mantri Gram Sadak Yojana (PMGSY)

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57. Which of the following is NOT generally considered a direct benefit of organizing rural women into Self Help Groups (SHGs)?
(A) Development and encouragement of regular micro-saving habits among rural women
(B) Direct appointment of SHG members to permanent government jobs
(C) Easy access to micro-finance and formal bank credit without collateral requirements
(D) Sustainable improvement in intra-household financial decision-making power of women

58. Which of the following represents the most appropriate definition of the primary goal of the National Agriculture Market (e-NAM)?
(A) To eliminate physical agriculture markets and force farmers to sell only to the Food Corporation of India
(B) To create a unified national market for agricultural commodities by networking existing APMC mandis
(C) To fix a single, unchangeable maximum retail price for all agricultural crops across India
(D) To strictly prohibit the interstate transport of agricultural produce

59. Under the organic farming promotion scheme (PKVY), how much total financial assistance is provided per hectare over a period of three years to the farmer for organic inputs, certification, and marketing?
(A) Rs. 10,000
(B) Rs. 25,000
(C) Rs. 50,000
(D) Rs. 100,000

60. To ensure the authenticity of organic products produced by farmers under PKVY in the domestic market, which decentralized certification system has been adopted by the Government of India?
(A) ISO 9001:2015 International Quality Management System Certification
(B) Agmark Standard Agricultural Produce Grading and Marking Certification
(C) Participatory Guarantee System for India (PGS-India)
(D) FSSAI Food Safety and Standards Authority Premium Certification

61. Under which component of the PM-KUSUM scheme does the state government provide subsidies to farmers for the installation of standalone solar agriculture pumps to ensure energy security in irrigation?
(A) Component A
(B) Component B
(C) Component C
(D) Component D

62. The Uttar Pradesh government has approved the 'Mukhya Mantri Khet Suraksha Yojana' to protect crops from stray animals. What is the primary intervention subsidized under this scheme?
(A) Erection of deep concrete boundary walls and physical barriers around the field
(B) Hiring of armed private security guards by the local village panchayat
(C) Installation of low-voltage solar fencing to deter animals
(D) Distribution of chemical pest repellents and sprays to apply on growing crops

63. Which of the following statements correctly describes the credit limit enhancement feature under the Kisan Credit Card (KCC) scheme for farmers over the five-year validity period of the card?
(A) The limit remains strictly fixed at the initial sanctioned level for five years.
(B) A 10 percent continuous increase in the short-term credit limit is provided every year.
(C) The limit doubles automatically every six months regardless of the cropping pattern.
(D) The limit decreases by 5 percent every year to systematically reduce farmer debt.

64. To enhance the income of beneficiaries under the Pradhan Mantri Awas Yojana - Gramin (PMAY-G), the construction of the house is converged with which other scheme to provide additional 90/95 days of unskilled wage employment to the beneficiary?
(A) Pradhan Mantri Gram Sadak Yojana (PMGSY)
(B) National Rural Livelihood Mission (NRLM)
(C) Jal Jeevan Mission (JJM)
(D) Mahatma Gandhi NREGA

65. Given below are two statements regarding the Pradhan Mantri Krishi Sinchayee Yojana (PMKSY):
Statement I: The "Har Khet Ko Pani" component focuses on creating new water sources through minor irrigation and repairing traditional water

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ANSWERS

1. (B) Rs. 6,000 payable in three equal installments
Under the Pradhan Mantri Kisan Samman Nidhi scheme, all eligible landholding farmer families receive direct income support from the Central Government. The annual financial assistance totals six thousand rupees, which is disbursed directly into bank accounts in three equal installments of two thousand rupees every four months to meet financial needs.

2. (B) 100 days
The Mahatma Gandhi National Rural Employment Guarantee Act guarantees social security by providing wage employment in rural areas. Every rural household whose adult members volunteer to undertake unskilled manual work is legally entitled to receive a minimum of one hundred days of guaranteed employment during every financial year to enhance livelihood security.

3. (A) P-3, Q-1, R-2, S-4
Key flagship national agricultural initiatives were launched across different years to empower Indian farmers. The Kisan Credit Card scheme was established in 1998, followed by the Soil Health Card scheme in 2015. Subsequently, the Pradhan Mantri Fasal Bima Yojana was introduced in 2016, and PM-KISAN was officially launched in 2019.

4. (B) 500 persons
The Pradhan Mantri Gram Sadak Yojana seeks to provide all-weather road connectivity to eligible unconnected habitations in rural areas. In plain areas, habitations with a population of five hundred persons and above are eligible for connectivity, whereas for hill states, desert regions, and tribal areas, the threshold limit is lower.

5. (D) I, II and III
Under the Pradhan Mantri Fasal Bima Yojana, uniform maximum premium rates are charged to farmers across the country. The premium rate payable by farmers is fixed at two percent for all food and oilseed crops grown during the Kharif season, one and a half percent for Rabi crops, and five percent for annual commercial and horticultural crops.

6. (A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
The Soil Health Card scheme was instituted to inform farmers about the nutrient status of their farm soil. By detailing specific crop-wise recommendations for nutrients and fertilizers needed based on soil testing, it guides farmers to apply balanced amounts of fertilizers, thereby improving overall soil fertility, crop yields, and farm productivity.

7. (C) 4 percent
Under the Kisan Credit Card scheme, short-term crop loans up to three lakh rupees are provided at a basic interest rate of seven percent per annum. To promote financial discipline, the Central Government provides an additional three percent prompt repayment incentive, reducing the effective interest rate to four percent for prompt payers.

8. (A) Molybdenum (Mo)
A Soil Health Card evaluates twelve standard physical and chemical soil parameters across four categories. These include macro-nutrients like Nitrogen, Phosphorus, and Potassium; secondary nutrients like Sulphur; micro-nutrients including Zinc, Iron, Copper, Manganese, and Boron; and physical parameters comprising pH, Electrical Conductivity, and Organic Carbon. Molybdenum is not tested in this standard card.

9. (C) 50 acres
The Paramparagat Krishi Vikas Yojana promotes organic farming by forming clusters of farmers. Under this scheme, organic farming is adopted using a cluster approach where a group of farmers forms a cluster covering a minimum standard land area of fifty acres or twenty hectares to facilitate collective farming, certification, and marketing activities.

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10. (A) Soil sampling → Soil testing in laboratory → Uploading data on web portal → Generation of Soil Health Card
The execution of the Soil Health Card scheme follows a structured chronological sequence at the field level. It begins with soil sampling from agricultural fields, followed by laboratory analysis of soil samples. Subsequently, the test results are uploaded to the web portal, leading to the final generation and distribution of soil health cards.

11. (C) Rs. 5,000,000
The Mukhyamantri Krishak Durghatna Kalyan Yojana of Uttar Pradesh provides financial security to farming families in the event of accidental mishaps. In the unfortunate event of an accidental death or one hundred percent permanent disability of an eligible farmer, maximum financial assistance of five lakh rupees is provided to the affected family.

12. (C) Small Farmers Agribusiness Consortium (SFAC)
The National Agriculture Market is an electronic trading portal that integrates existing APMC mandis to create a unified national market for agricultural commodities. The Small Farmers Agribusiness Consortium serves as the lead agency for implementing this platform under the aegis of the Ministry of Agriculture and Farmers Welfare, Government of India.

13. (B) 25 square meters
The Pradhan Mantri Awas Yojana - Gramin aims to provide durable pucca housing with basic amenities to homeless and vulnerable rural households. The scheme mandates a minimum built-up unit area of twenty-five square meters for each house, which excludes dedicated sanitary space like a toilet, ensuring adequate living space for beneficiaries.

14. (A) I, II and III only
The Enterprise Resource Planning system and E-Ganna application were developed by Uttar Pradesh to benefit sugarcane growers. The platform provides transparent access to supply tickets, calendars, and weighments online, thereby curbing middlemen and corruption. The service is provided completely free of charge to farmers, making mandatory annual subscription fees incorrect.

15. (A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
Micro-irrigation techniques, particularly drip irrigation, deliver water directly to the crop root zones through a network of pipes. Because water application is restricted strictly to the cultivated plant roots, the soil surface in inter-row spaces remains dry, preventing weed seed germination and substantially reducing unwanted weed growth in agricultural fields.

16. (B) 40 to 50 percent
The Sub-Mission on Agricultural Mechanization aims to promote farm mechanization among small landholders across India. Under this program, financial assistance in the form of subsidy ranging between forty and fifty percent is provided to General Category farmers for purchasing standard agricultural machinery, while higher financial subsidies are extended to vulnerable categories.

17. (A) Indian Council of Agricultural Research (ICAR)
The Central Sector Scheme for the formation and promotion of ten thousand Farmer Producer Organizations utilizes designated primary implementing agencies. These agencies include the Small Farmers Agribusiness Consortium, National Bank for Agriculture and Rural Development, and National Cooperative Development Corporation. The Indian Council of Agricultural Research functions as a research organization rather than an implementation agency.

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18. (B) 10 to 20 members
Under the Deendayal Antyodaya Yojana - National Rural Livelihoods Mission, self-help groups serve as primary affinity-based community institutions. A standard self-help group consists of ten to twenty poor women who come together to save small amounts regularly, manage internal credit, and access formal institutional financial assistance for sustainable livelihood activities.

19. (B) 2024
The Jal Jeevan Mission, launched by the Ministry of Jal Shakti, aims to ensure public health and rural transformation. The scheme set the target year of 2024 to provide functional household tap connections supplying safe and adequate drinking water to every rural household across all states and union territories in India.

20. (A) P-3, Q-4, R-1, S-2
Various national agricultural schemes address key development objectives. The Per Drop More Crop component under PMKSY promotes micro-irrigation to maximize water efficiency, e-NAM establishes a unified national digital market for produce, PKVY encourages organic farming methods, and RKVY grants operational flexibility and autonomy to states for agricultural planning.

21. (A) I and II only
To fulfill working capital needs, the Kisan Credit Card scheme was extended beyond crop cultivation to cover animal husbandry and fisheries farmers. Furthermore, the Central Government raised the collateral-free agricultural loan limit from one lakh rupees to one lakh sixty thousand rupees, making the reduction to fifty thousand rupees incorrect.

22. (B) 18 to 70 years
The Mukhyamantri Krishak Durghatna Kalyan Yojana in Uttar Pradesh provides financial relief to agricultural families facing casualties. To be eligible for financial aid under this safety net, the affected farmer or family member participating in agricultural activities must fall within the prescribed age bracket of eighteen to seventy years.

23. (A) 2, 4, 1, 3
The operational workflow of electronic trading on the National Agriculture Market portal follows a defined sequence. The process begins with gate entry of produce at the APMC mandi, followed by quality assaying in testing labs. Next, traders participate in online e-bidding, culminating in final weighment and digital e-payments.

24. (A) Digital India Land Records Modernization Programme (DILRMP)
The Digital India Land Records Modernization Programme focuses on updating and digitizing land records across the nation. By computerizing land records, spatial maps, and property titles, the program aims to establish transparent land management systems, minimize land disputes, and facilitate seamless credit access and conclusive title guarantees for farmers.

25. (C) 4 percent
Short-term crop loans provided under the Kisan Credit Card scheme carry a baseline benchmark interest rate of seven percent per annum. Farmers who demonstrate prompt financial discipline by repaying their crop loans on time receive a three percent interest subvention, effectively reducing their annual net borrowing interest rate to four percent.

26. (A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
The e-NAM electronic trading platform creates a unified market by connecting physical APMC wholesale markets online. By bringing together buyers and sellers across different regions onto a single digital interface, it fosters competitive bidding, removes information asymmetry regarding prevailing market prices, and enables farmers to realize better prices for produce.

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27. (A) Agri-entrepreneurship and agribusiness incubation
The Rashtriya Krishi Vikas Yojana was revamped as RKVY-RAFTAAR, standing for Remunerative Approaches for Agriculture and Allied Sectors Rejuvenation. A main highlight of this initiative is fostering agri-entrepreneurship, supporting agribusiness incubators, and offering seed funding to innovative youth and startups engaged in developing cutting-edge technology for agricultural sector value addition.

28. (C) IV only
Under the Pradhan Mantri Awas Yojana - Gramin, unit cost sharing follows a 60:40 ratio in plain states and 90:10 in northeastern and Himalayan states, transferred directly to beneficiary accounts. The scheme provides financial assistance as a direct capital grant rather than a loan, making the assertion that it only provides loans incorrect.

29. (D) Providing free electricity for drawing groundwater in all states
Pradhan Mantri Krishi Sinchayee Yojana focuses on field-level irrigation convergence, efficient water utilization via micro-irrigation under Per Drop More Crop, and watershed management for groundwater recharge. Providing free electricity for groundwater pumping is not an objective of this national scheme, as power tariffs fall under individual state policy jurisdictions.

30. (C) 300 members
The Central Sector Scheme for the formation and promotion of ten thousand Farmer Producer

(D) Deendayal Antyodaya Yojana (DAY-NRLM)

74. Which of the following is the most direct benefit of the "E-Ganna" mobile application for the sugarcane farmers of Uttar Pradesh?
(A) They can purchase heavily discounted smartphones and electronic accessories directly through government vendors
(B) They can check their cane survey data, quota, and supply slips online
(C) They can directly apply for an official international passport using their registered cane farmer identification
(D) They receive free high-speed broadband internet data connectivity packages for their entire village

75. Given below are two statements regarding the SHG-Bank Linkage Programme, which forms the backbone of the DAY-NRLM scheme:
Statement I: The SHG-Bank Linkage Programme was originally piloted and launched by NABARD in India.
Statement II: It enables informal Self Help Groups to open bank accounts and access formal bank credit.
(A) Both Statement I and Statement II are correct
(B) Both Statement I and Statement II are incorrect
(C) Statement I is correct, but Statement II is incorrect
(D) Statement I is incorrect, but Statement II is correct

76. Various digital portals have been established to ensure ease of services for farmers under the Digital India initiative. Which of the following portals/apps is NOT directly related to agriculture or farmer welfare?
(A) Kisan Suvidha App
(B) e-NAM Portal
(C) e-Chhawani Portal
(D) FARMS (Farm Machinery Solutions) App

77. The Deendayal Antyodaya Yojana - National Rural Livelihood Mission (DAY-NRLM) is a restructured version of which earlier poverty alleviation scheme?
(A) Indira Awaas Yojana (IAY) housing scheme
(B) Sampoorna Grameen Rozgar Yojana (SGRY)
(C) Jawahar Rozgar Yojana (JRY) employment scheme
(D) Swarnajayanti Gram Swarozgar Yojana (SGSY)

78. A standard Soil Health Card indicates the status of the soil with respect to a specific number of parameters (comprising macro nutrients, secondary nutrient, micro nutrients, and physical parameters). What is this exact total number of parameters?
(A) 8
(B) 10
(C) 12
(D) 16

79. Which of the following is the most appropriate reason why rural connectivity through the PMGSY is considered crucial for farmer welfare and agricultural development?
(A) It drastically reduces the manufacturing and retail procurement cost of chemical fertilizers across state borders
(B) It enables rapid transport of agricultural produce from farm gates to mandis
(C) It completely eliminates the requirement for crop insurance coverage by preventing localized weather disasters
(D) It guarantees free and uninterrupted electricity supply to all rural households and agricultural pump sets

80. Identify the INCORRECT statement regarding the current provisions of the Pradhan Mantri Fasal Bima Yojana (PMFBY):
(A) It utilizes modern technologies like remote sensing, drones, and smartphones for quick estimation of crop losses
(B) It covers widespread yield losses due to non-preventable risks like natural fire, storm, hailstorm, cyclone, and drought
(C) It provides specific coverage for post-harvest losses caused by unseasonal rainfall for crops kept in the field to dry
(D) Enrollment is mandatory for all loanee farmers since Kharif 2020.

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and drastically enhances their commercial negotiating power in agricultural markets.

40. (A) To meet immediate credit needs of members and encourage bank borrowing
Under the DAY-NRLM scheme, a Revolving Fund is extended to eligible Self Help Groups that demonstrate regular savings and internal lending habits. This grant acts as catalytic capital to meet short-term emergency financial requirements of members, reinforce financial management capabilities, and build credibility for securing formal bank credit linkage.

41. (A) I and II only
The Mukhyamantri Krishak Durghatna Kalyan Yojana in Uttar Pradesh covers registered landholders and co-sharers listed in revenue records. The scope was expanded to include landless agricultural laborers and tenant farmers who derive their primary livelihood from farming, making the statement that landless agricultural workers are strictly excluded incorrect.

42. (B) Rent farm machinery and implements to small and marginal farmers
Custom Hiring Centres are operational hubs established to make expensive farm machinery accessible to small and marginal farmers. These centres purchase advanced tractors, harvesters, and land preparation implements, offering them on a affordable rental basis to nearby farmers who cannot afford to buy high-cost equipment independently.

43. (A) Marginal farmers holding less than 1 hectare of cultivable land
The PM-KISAN scheme targets small and marginal farm families who hold cultivable land. Marginal farmers owning less than one hectare of land are fully eligible for income support. In contrast, income tax payers, government medical doctors, and former Members of Parliament are specifically listed under exclusion categories and cannot receive benefits.

44. (C) Pradhan Mantri Awas Yojana (Gramin) - Construction of pucca houses
Rural development schemes target distinct structural priorities. Pradhan Mantri Awas Yojana (Gramin) focuses specifically on facilitating the construction of durable pucca houses for homeless and poorly housed rural families. Other schemes serve alternative functions, such as road connectivity under PMGSY, skill training under DAY-NRLM, and organic farming under PKVY.

45. (C) 60:40 (Centre:State)
The Deendayal Antyodaya Yojana - National Rural Livelihoods Mission operates as a centrally sponsored flagship scheme. For general category states, including Uttar Pradesh, the financial expenditure required for implementing the program is shared between the Central Government and the respective State Government in a sixty to forty funding ratio.

46. (A) Both Statement I and Statement II are correct
The Jal Jeevan Mission, managed by the Ministry of Jal Shakti, aims to enhance rural public health and quality of life. Its mandate is to supply fifty-five liters of potable water per person per day directly to all rural households strictly through functional household tap connections on a long-term sustainable basis.

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47. (C) Rs. 1 lakh crore
The Agriculture Infrastructure Fund is a medium-to-long term financing facility launched by the Government of India. With a total fund allocation size of one lakh crore rupees, it provides interest subvention and credit guarantee support to build post-harvest management infrastructure, cold chains, and community farming assets across rural regions.

48. (D) Khandsari and Gur units
To support rural cottage industries and sugarcane utilization in Uttar Pradesh, the state government streamlined the regulatory environment. Licensing procedures for establishing traditional rural jaggery and unrefined sugar production units, specifically Gur and Khandsari units, were simplified and moved entirely online to encourage local enterprise and timely cane processing.

49. (A) Connecting habitations to Gramin Agricultural Markets, higher secondary schools, and hospitals
Phase-III of the Pradhan Mantri Gram Sadak Yojana prioritizes consolidating key rural road networks. Rather than focusing solely on basic initial connectivity, Phase-III emphasizes upgrading and constructing routes that link rural habitations directly to Gramin Agricultural Markets, higher educational institutions, and

healthcare centers to improve socio-economic mobility.

50. (C) Village Poverty Reduction Plan
Under the DAY-NRLM scheme, the Village Poverty Reduction Plan serves as a comprehensive community demand plan prepared by Self Help Group networks. It aggregates local demands related to basic amenities, social entitlements, public goods, and sustainable livelihood support, which are subsequently integrated into Gram Panchayat Development Plans for implementation.

51. (A) P-4, Q-1, R-2, S-3
Key rural and agricultural tools serve designated institutional functions. The e-NAM portal facilitates electronic trading across mandis, Custom Hiring Centres offer farm machinery on rent, Farmer Producer Organizations drive collective input buying and product marketing, and Self Help Groups promote micro-credit and women's socio-economic empowerment in rural areas.

52. (B) Rs. 2,000
Under the PM-KISAN scheme, total annual financial assistance of six thousand rupees is distributed across three equal four-monthly installments. Consequently, an eligible registered sugarcane farmer in Saharanpur, Uttar Pradesh, receives exactly two thousand rupees directly credited into his linked bank account during each single installment release.

53. (B) 15 to 35 years
Deen Dayal Upadhyaya Grameen Kaushalya Yojana focuses on diversifying rural household incomes by building occupational skills. The scheme specifically targets poor rural youth within the standard age group of fifteen to thirty-five years, offering them placement-linked skill training to secure sustainable employment in various industrial and service sectors.

54. (C) PMFBY - General Insurance Companies (e-panelled)
The Pradhan Mantri Fasal Bima Yojana relies on empanelled public and private general insurance companies to manage crop insurance policies, evaluate loss claims, and disburse compensation. Conversely, KCC loans are issued by commercial and cooperative banks, Soil Health Cards are managed by agriculture departments, and MGNREGA involves Gram Panchayats.

55. (C) 200 kg
Commercial Urea fertilizer typically contains forty-six percent elemental Nitrogen by weight. To deliver ninety-two kilograms of elemental Nitrogen per hectare as recommended by a Soil Health Card, a farmer must apply exactly two hundred kilograms of Urea fertilizer, since two hundred multiplied by forty-six percent yields ninety-two kilograms of Nitrogen.

56. (C) Statement I is correct, but Statement II is incorrect
Common Service Centres act as vital rural access points delivering digital public services, social schemes, and agricultural information to villagers. However, the e-Panchayat project aims to digitally empower and automate internal governance functions of Gram Panchayats rather than replacing rural local bodies with urban municipalities, making the second assertion incorrect.

57. (B) Direct appointment of SHG members to permanent government jobs
Organizing rural women into Self Help Groups promotes thrift habits, provides access to collateral-free micro-finance, and strengthens household decision-making autonomy. However, membership in a self-help group does not guarantee or include direct recruitment into permanent government employment positions, as public appointments follow separate statutory competitive selection procedures.

58. (B) To create a unified national market for agricultural commodities by networking existing APMC mandis
The core objective of the National Agriculture Market is to form a unified national market for agricultural commodities. It achieves this by networking existing APMC physical market yards onto a common digital trading platform, eliminating spatial barriers, encouraging transparent price discovery through open electronic bidding, and giving farmers broader buyer access.

59. (C) Rs. 50,000
Under the Paramparagat Krishi Vikas Yojana, total financial assistance of fifty thousand rupees per hectare is allocated over a three-year period.

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Out of this total amount, thirty-one thousand rupees is directly transferred to farmers for purchasing organic inputs such as bio-fertilizers, seeds, and traditional organic preparations.

60. (C) Participatory Guarantee System for India (PGS-India)
To certify organic produce grown under PKVY, the Government of India relies on the Participatory Guarantee System for India. This peer-review certification process allows groups of local farmers to inspect and certify one another's organic practices, ensuring credibility, affordability, and streamlined market access without incurring expensive third-party audit fees.

61. (B) Component B
The Pradhan Mantri Kisan Urja Suraksha evam Utthaan Mahabhiyan scheme comprises three distinct components to solarize the agricultural sector. Component B specifically provides financial subsidies to individual farmers to install standalone solar-powered agriculture water pumps, replacing diesel pumpsets and ensuring clean, uninterrupted energy for field irrigation.

62. (C) Installation of low-voltage solar fencing to deter animals
The Mukhya Mantri Khet Suraksha Yojana in Uttar Pradesh was formulated to safeguard standing crops from damage caused by wild and stray animals. The main intervention subsidized under this scheme is installing low-voltage solar powered fencing around fields, which delivers a mild, non-lethal shock to deter animals safely.

63. (B) A 10 percent continuous increase in the short-term credit limit is provided every year.
The Kisan Credit Card facility features a flexible limit structure valid for a five-year period. To accommodate rising input costs and evolving cropping intensity, a automatic ten percent annual increase in the short-term credit limit is built into the card for farmers who maintain satisfactory account operation and repayment habits.

64. (D) Mahatma Gandhi NREGA
To enhance support for low-income beneficiaries under the Pradhan Mantri Awas Yojana - Gramin, house construction is linked with the Mahatma Gandhi NREGA. Beneficiaries are entitled to receive up to ninety or ninety-five days of unskilled wage employment payments for constructing their own home, providing supplementary financial assistance during construction.

65. (A) Both Statement I and Statement II are correct
The Pradhan Mantri Krishi Sinchayee Yojana integrates multiple conservation components. The Har Khet Ko Pani component focuses on expanding surface water bodies and minor irrigation structures, while the Watershed Development component concentrates on soil moisture conservation, rainwater harvesting, runoff management, and preventing soil erosion in rainfed areas.

66. (C) A unit offering farm machinery and equipment for custom hiring by farmers
A Custom Hiring Centre is an operational agricultural facility equipped with a wide variety of power-driven farm machinery, implements, and tools. Designed to support resource-constrained small and marginal farmers, it offers advanced machinery on a affordable rental basis, improving land productivity without requiring heavy capital investments from individual farmers.

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67. (A) Self-Propelled Combine Harvester
While basic agricultural tools like sprayers, cultivators, and seed drills are subsidized for individual small and marginal farmers, high-cost specialized machinery like self-propelled combine harvesters is generally not subsidized for single small landholders. Instead, such heavy capital equipment is promoted through Custom Hiring Centres for collective community utilization.

68. (D) Village Water and Sanitation Committee (VWSC)
The Jal Jeevan Mission emphasizes decentralized community-managed water supply systems. At the village level, the Village Water and Sanitation Committee, functioning as a sub-committee of the Gram Panchayat, is mandated to prepare village action plans, execute in-village drinking water infrastructure, and handle daily operational maintenance of tap connections.

69. (B) The Chief Secretary of the State
Under the operational framework of the Rashtriya Krishi Vikas Yojana, administrative decision-making authority for approving state

CHAPTER 22

Principles of Agricultural Economics and the one Trillion Economy

1. To achieve the overarching goal of a One Trillion Dollar economy, the Government of Uttar Pradesh has targeted which of the following years?
(A) 2024-25
(B) 2027-28
(C) 2030-31
(D) 2035-36

2. According to the classical production function in agricultural economics, a rational farmer will always aim to operate in which stage of production?
(A) Stage I, where marginal product is increasing
(B) Stage II, where marginal product is decreasing but positive
(C) Stage III, where marginal product is negative
(D) Stage I, where total product is zero

3. What is the approximate share of the agriculture and allied sector in the Gross State Value Added (GSVA) of Uttar Pradesh, making it a critical driver for the trillion-dollar economy?
(A) 10 to 12 percent
(B) 15 to 18 percent
(C) 24 to 26 percent
(D) 40 to 45 percent

4. Consider the following statements regarding the sugarcane industry's contribution to the Uttar Pradesh economy:
I. It is the largest agro-based industry in the state.
II. It provides direct employment to over 50 lakh farming families.
III. It contributes negligible revenue to the state exchequer.
Which of the above statements is/are correct?
(A) I and II only
(B) II and III only
(C) I and III only
(D) I, II and III

5. In agricultural project planning, a project is generally considered economically viable if the Benefit-Cost Ratio (BCR) calculated at a given discount rate is:
(A) Exactly zero
(B) Less than one
(C) Greater than one
(D) Equal to the marginal cost

6. In the context of the double-engine development model for strengthening the rural economy, which of the following best describes the core mechanism?
(A) Complete privatization of primary and secondary agricultural marketing channels
(B) Direct foreign investment in basic farming operations and infrastructure
(C) Total replacement of human labour with heavy machinery across all districts
(D) Synergy and convergence of Central Government and State Government schemes

7. The demand for basic agricultural food commodities in the market is generally characterized as:
(A) Perfectly elastic
(B) Highly elastic
(C) Relatively inelastic
(D) Perfectly inelastic

8. Which of the following sugarcane by-products has emerged as a major contributor to the rural economy through the national ethanol blending programme?
(A) Bagasse
(B) Press mud
(C) Molasses
(D) Cane trash

9. Given below are two statements, one labelled as Assertion (A) and the other as Reason (R):
Assertion (A): Public investment in rural infrastructure, such as irrigation and roads, is crucial for agricultural growth.

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79. (B) It enables rapid transport of agricultural produce from farm gates to mandis
All-weather road connectivity provided through the Pradhan Mantri Gram Sadak Yojana is crucial for agricultural development. By linking isolated rural villages to main road networks, it enables swift, cost-effective transportation of perishable farm produce from field gates to wholesale mandis, reducing post-harvest transit losses and securing better market prices.

80. (D) Enrollment is mandatory for all loanee farmers since Kharif 2020.
The Pradhan Mantri Fasal Bima Yojana covers widespread natural yield losses and post-harvest risks using advanced technologies like satellite imagery and drones for assessment. Effective from Kharif 2020, enrollment under PMFBY was made completely voluntary for all farmers, including loanee farmers, making the statement of mandatory enrollment incorrect.

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58. Match List I with List II and select the correct option:
List I: (Sugarcane By-product)
P. Bagasse
Q. Molasses
R. Press Mud
S. Cane Tops
List II: (Agro-industrial Economic Use)
1. Cattle fodder
2. Co-generation of electricity
3. Ethanol and distillery industry
4. Bio-compost manufacturing
(A) P-2, Q-3, R-4, S-1
(B) P-3, Q-2, R-1, S-4
(C) P-4, Q-1, R-2, S-3
(D) P-2, Q-4, R-3, S-1

59. In the context of the agricultural economy of Uttar Pradesh, a farmer holding less than 1 hectare of agricultural land is economically classified as a:
(A) Small Farmer
(B) Marginal Farmer
(C) Semi-Medium Farmer
(D) Large Farmer

60. A farmer deciding to change their farming practice from a standard sugarcane variety to a new early-maturing high-sugar variety should use which economic tool to calculate the expected change in profit?
(A) Complete Budgeting
(B) Partial Budgeting
(C) Balance Sheet
(D) Cash Flow Statement

61. If a sugarcane farmer expects the price of fertilizer to increase significantly in the next season, the law of supply suggests that the fertilizer companies will likely:
(A) Increase the quantity of fertilizer supplied
(B) Decrease the quantity of fertilizer supplied
(C) Keep the supply exactly constant
(D) Stop manufacturing fertilizer entirely

62. Which of the following best describes the shape of the Average Fixed Cost (AFC) curve for an agricultural enterprise?
(A) U-shaped
(B) Upward sloping straight line
(C) Rectangular hyperbola
(D) Horizontal straight line

63. Under the Sugarcane (Regulation of Supply and Purchase) framework, the ticketing system (Purchi) is an economic tool designed primarily to:
(A) Strictly restrict small marginal farmers from selling their harvested produce
(B) Allow private sugar mills to completely bypass official minimum price regulations
(C) Substitute direct financial cash payments with physical agricultural goods
(D) Regulate equitable and timely supply of cane to sugar mills

64. Consider the following features of Uttar Pradesh's agricultural economy:
I. It has the largest area under wheat cultivation in India.
II. It is a leading producer of potatoes and milk.
III. Most of its operational landholdings belong to the large farmer category.
IV. The state benefits from a vast network of rivers and fertile Indo-Gangetic plains.
Which of the above statements is/are correct?
(A) I, II and IV only
(B) II, III and IV only
(C) I, III and IV only
(D) I, II, III and IV

65. The most profitable level of agricultural production is reached when the Marginal Physical Product (MPP) is equal to the:
(A) Inverse price ratio of product and input (P_x/P_y)
(B) Price ratio of input and product (P_x/P_y)
(C) Total physical product
(D) Average physical product

66. The phrase "Amrit Kaal", frequently used in the context of the One Trillion Dollar economy vision, generally refers to the economic development period spanning up to which milestone year of Indian independence?
(A) 50th year (1997)
(B) 75th year (2022)
(C) 100th year (2047)
(D) 125th year (2072)

67. The per capita income of a state, a key indicator in the One Trillion Dollar economy goal, is calculated by:
(A) Dividing the total state income by its total population
(B) Multiplying total tax revenue by the population

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Reason (R): Private investment by farmers in agriculture generally increases following public investment in infrastructure.
Which of the following is correct?
(A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
(B) Both Assertion (A) and Reason (R) are true but R is not the correct explanation of A.
(C) Assertion (A) is true but Reason (R) is false.
(D) Assertion (A) is false but Reason (R) is true.

10. The value of the next best alternative foregone when a farmer decides to allocate their land to cultivate sugarcane instead of wheat is known in economics as:
(A) Opportunity cost
(B) Historical sunk cost
(C) Direct marginal cost
(D) Short-run fixed cost

11. Value-chain development in agriculture contributes to economic growth primarily by:
(A) Significantly decreasing the final consumer market price well below total production costs
(B) Increasing the shelf life, utility, and market value of primary produce
(C) Complete elimination of all supply chain intermediaries without adding processing value
(D) Substantially reducing the total physical quantity of produce available for consumption

12. Select the correct sequence of the three classical stages of the agricultural production function based on the behavior of Marginal Product (MP):
(A) MP is negative, MP is increasing, MP is zero
(B) MP is increasing, MP is decreasing but positive, MP is negative
(C) MP is decreasing, MP is increasing, MP is constant
(D) MP is zero, MP is negative, MP is positive

13. Which of the following is considered a fixed cost for a sugarcane farmer in the short run?
(A) Land revenue and permanent lease rent
(B) Cost of urea fertilizer
(C) Wages paid to casual laborers for harvesting
(D) Expenditure on tractor fuel for ploughing

14. Which agricultural strategy is most essential for Uttar Pradesh to achieve the One Trillion Dollar economy target?
(A) Shifting the state cultivation focus completely from cash crops to traditional cereal crops
(B) Relying exclusively on natural monsoon rains without expanding modern canal irrigation
(C) Promoting crop diversification, agro-processing, and agricultural exports
(D) Enforcing a complete ban on the establishment of new agriculture-based enterprise startups

15. Consider the following statements regarding the principle of demand and supply for agricultural products:
I. An unexpected bumper harvest often leads to a sharp decline in market prices.
II. Supply of agricultural products can be instantly adjusted to match daily price changes.
III. Price fluctuations are severe because agricultural supply is biologically constrained in the short run.
Which of the above statements is/are correct?
(A) I and II only
(B) II and III only
(C) I and III only
(D) I, II and III

16. What is the rank of Uttar Pradesh in total sugarcane and sugar production in India?
(A) First
(B) Second
(C) Third
(D) Fourth

17. The Law of Diminishing Marginal Productivity states that as more units of a variable input (like fertilizer) are added to a fixed input (like land), the additional output will eventually:
(A) Increase at an increasing rate
(B) Decline
(C) Remain constant forever
(D) Become perfectly elastic

18. Match List I with List II and select the correct option:
List I: (Economic Principle)
P. Factor-Product Relationship
Q. Factor-Factor Relationship
R. Product-Product Relationship
S. Time Comparison
List II: (Practical Agricultural Decision)
1. What to produce (Enterprise combination)
2. How to produce (Least-cost combination)
3. How much to produce (Profit maximization)

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4. When to buy and sell
(A) P-3, Q-2, R-1, S-4
(B) P-1, Q-2, R-3, S-4
(C) P-3, Q-1, R-2, S-4
(D) P-2, Q-3, R-1, S-4

19. The Fair and Remunerative Price (FRP) for sugarcane is announced by the Central Government on the recommendation of which body?
(A) Commission for Agricultural Costs and Prices (CACP)
(B) National Institution for Transforming India (NITI Aayog)
(C) Indian Council of Agricultural Research Division (ICAR)
(D) Central Sugarcane Breeding Research Institute

20. In agricultural economics, Marginal Product (MP) is defined as:
(A) Total physical output generated divided by the total number of units of inputs used
(B) Total financial cost incurred by the farmer during the complete crop production cycle
(C) Change in total output from using one additional unit of variable input
(D) Total physical quantity of agricultural produce lost during harvesting and transport

21. Which sector forms the structural foundation of the rural economy in Uttar Pradesh, providing maximum employment opportunities?
(A) Agriculture and Allied Sectors
(B) Information Technology and Software Services
(C) Heavy Manufacturing and Industrial Sectors
(D) Financial Services and Banking Sector

22. Consider the following statements regarding the strategy to achieve a One Trillion Dollar economy in Uttar Pradesh:
I. Accelerating growth in the primary sector is essential.
II. Promoting agro-based start-ups and food processing.
III. Shifting public investment entirely away from agriculture to services.
IV. Enhancing agricultural exports through value-chain development.
Which of the above statements is/are incorrect?
(A) I and II only
(B) III only
(C) I, II and IV only
(D) III and IV only

23. The traditional Gur (Jaggery) and Khandsari units in Uttar Pradesh are significant to the rural economy primarily because they:
(A) Require large-scale influx of direct foreign investment capital
(B) Are decentralized and labor-intensive, providing local employment
(C) Produce specialized raw materials exclusively used in the textile industry
(D) Operate entirely on modern solar energy systems without utilizing sugarcane

24. Which apex body is primarily responsible for the promotion of agricultural exports from India, thereby integrating state farmers into the global economy?
(A) FSSAI
(B) FCI
(C) APEDA
(D) NABARD

25. Which among the following represents direct employment provided by the sugar industry in Uttar Pradesh?
(A) Manufacturing of heavy tractors and implements used by agricultural farmers
(B) Daily operation of roadside eateries and dhabas located near sugar mill premises
(C) Large-scale production of chemical fertilizers in a separate industrial plant
(D) Direct employment of technicians, engineers, and mill workers

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26. The Break-Even Point in an agricultural enterprise is the level of production at which:
(A) Total revenue equals total cost
(B) Total enterprise revenue exactly equals total variable costs
(C) Marginal revenue from production drops to zero
(D) All fixed production costs are completely eliminated

27. The principle of equi-marginal returns is most useful for a farmer when they have:
(A) Access to unlimited capital resources and agricultural land area
(B) Limited capital to allocate among competing enterprises
(C) Complete absence of variable operating costs in farm planning
(D) Guaranteed stable fixed market price for all

cultivated crops

28. Cooperative Cane Development Societies in Uttar Pradesh play a pivotal role in the economy by acting as a crucial link between:
(A) Central Government economic ministries and international financial bodies like World Bank
(B) Sugarcane farmers and sugar mills for transparent cane supply
(C) Private non-institutional money lenders and marginal landless farm laborers
(D) Large industrial manufacturing plants and urban retail product consumers

29. Given below are two statements, one labelled as Assertion (A) and the other as Reason (R):
Assertion (A): Agricultural commodities often experience steep price crashes during peak harvest seasons.
Reason (R): Agricultural products generally have inelastic demand, and a sudden increase in supply leads to a disproportionate fall in prices.
Which of the following is correct?
(A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
(B) Both Assertion (A) and Reason (R) are true but R is not the correct explanation of A.
(C) Assertion (A) is true but Reason (R) is false.
(D) Assertion (A) is false but Reason (R) is true.

30. Economic efficiency in agricultural production is achieved when a farmer successfully attains both:
(A) Maximum physical output and highest variable cost
(B) Minimum physical output and lowest fixed cost
(C) Technical efficiency and Allocative efficiency
(D) Highest product price and lowest market demand

31. Under the classification of economic sectors, the sugarcane cultivation by farmers in Uttar Pradesh falls under which sector?
(A) Secondary Sector
(B) Tertiary Sector
(C) Quaternary Sector
(D) Primary Sector

32. Capital formation in agriculture refers to:
(A) Physical printing and distribution of paper currency notes by rural regional banks
(B) Total accumulated institutional agricultural loan amount waived off by government
(C) Net addition to physical farm capital stock over a period
(D) Sum total of daily wage payments disbursed to casual agricultural laborers

33. Consider the following statements regarding cost-benefit analysis in agriculture:
I. It provides a basis for making investment decisions.
II. It helps evaluate the economic viability of installing a drip irrigation system.
III. It ignores the time value of money completely.
Which of the above statements is/are correct?
(A) I and II only
(B) II and III only
(C) I and III only
(D) I, II and III

34. The press mud generated from sugar mills is an economically valuable by-product primarily used as:
(A) High-grade aviation turbine fuel for commercial aircraft
(B) Essential raw material for manufacturing synthetic industrial plastics
(C) Balanced nutritional feed supplement for commercial poultry chicks
(D) Organic manure for soil fertility

35. The economic principle which states that the additional satisfaction a consumer derives from consuming successive units of a commodity declines is known as:
(A) Law of Diminishing Marginal Utility
(B) Law of Supply
(C) Law of Diminishing Marginal Returns
(D) Law of Equi-marginal Returns

36. For a farmer looking to maximize profits, the optimum level of input use is reached when:
(A) Total Revenue is at its lowest
(B) Marginal Cost is greater than Marginal Revenue
(C) Marginal Revenue equals Marginal Cost (MR = MC)
(D) Fixed Cost equals Variable Cost

37. For agricultural planning and policy-making based on agro-climatic variations, Uttar Pradesh is divided into how many Agro-Climatic Zones?
(A) 4
(B) 9
(C) 15

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(D) 20

38. Match List I with List II and select the correct option:
List I: (Cost Concept)
P. Fixed Cost
Q. Variable Cost
R. Marginal Cost
S. Total Cost
List II: (Definition)
1. Costs that change directly with the level of output
2. Sum of fixed and variable costs
3. Costs that remain constant regardless of output in the short run
4. Additional cost incurred to produce one more unit of output
(A) P-3, Q-1, R-4, S-2
(B) P-1, Q-3, R-2, S-4
(C) P-3, Q-4, R-1, S-2
(D) P-2, Q-1, R-4, S-3

39. Agriculture-based start-ups are emerging in the Uttar Pradesh economy primarily in which of the following areas?
(A) Deep sea mineral exploration and offshore mining operations
(B) Precision farming, logistics, and agri-fintech
(C) Heavy structural steel manufacturing and processing units
(D) Large-scale urban commercial real estate development projects

40. The State Advised Price (SAP) for sugarcane in Uttar Pradesh is determined by:
(A) The individual sugar mill owners
(B) The World Trade Organization
(C) The State Government
(D) The local village panchayat

41. Which of the following best represents a public investment in the agriculture sector?
(A) A private agricultural farmer purchasing a new modern tractor
(B) A private sugar mill owner upgrading high-capacity boiler machinery
(C) An emerging agri-tech startup raising early-stage venture capital funding
(D) Government construction of canal irrigation network

42. Consider the following agricultural strategies:
I. Increasing irrigation use efficiency.
II. Enhancing seed replacement rate.
III. Promoting farm mechanization.
IV. Reducing the Minimum Support Price (MSP) systematically.
Which of the above combinations represents positive strategies to boost agricultural GDP?
(A) I, II and IV only
(B) I, II and III only
(C) II, III and IV only
(D) I, III and IV only

43. In Stage II of the classical production function, the elasticity of production (Ep) is:
(A) Strictly greater than 1
(B) Exactly equal to 0
(C) Between 0 and 1
(D) Strictly less than 0

44. The highest percentage of the workforce in Uttar Pradesh is employed in which sector?
(A) Organized Heavy Manufacturing Industry
(B) Agriculture and Allied Sectors
(C) Information Technology and Software Services
(D) Hospitality and Tourism Industry

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45. What is the target percentage of ethanol blending in petrol set by the Government of India for the year 2025-26, which is heavily boosting the sugarcane economy?
(A) 5%
(B) 10%
(C) 20%
(D) 50%

46. In agricultural economics, the Value of Marginal Product (VMP) is calculated by multiplying the Marginal Physical Product (MPP) by:
(A) Total Production Cost
(B) Unit price of the variable input
(C) Price of the product (output)
(D) Average Physical Product of input

47. A farmer deciding whether to grow sugarcane or wheat based on which crop yields the highest net return per hectare is applying the principle of:
(A) Diminishing Marginal Utility
(B) Elasticity of Demand
(C) Inelastic Supply
(D) Comparative Advantage

48. An increase in the sugar recovery percentage in a sugar mill directly leads to:
(A) Significant increase in overall production cost per quintal of processed sugar
(B) Consistently lower economic returns and

profit margins for the sugar mill
(C) Higher sugar output from same quantity of crushed cane
(D) Rapid decrease in total byproduct ethanol production capacity

49. Given below are two statements, one labelled as Assertion (A) and the other as Reason (R):
Assertion (A): Operating a farm in Stage I of the production function is considered economically irrational for a producer.
Reason (R): In Stage I, the Marginal Product is increasing, meaning that adding more inputs will continue to increase the average efficiency of the variable input.
Which of the following is correct?
(A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
(B) Both Assertion (A) and Reason (R) are true but R is not the correct explanation of A.
(C) Assertion (A) is true but Reason (R) is false.
(D) Assertion (A) is false but Reason (R) is true.

50. Which central scheme is specifically designed to promote agri-entrepreneurship by providing training and financial support to agriculture graduates?
(A) Pradhan Mantri Kisan Samman Nidhi (PM-KISAN)
(B) Pradhan Mantri Annadata Aay SanraksHan Abhiyan (PM-AASHA)
(C) National Agriculture Market electronic trading portal (e-NAM)
(D) Agri-Clinics and Agri-Business Centres Scheme

51. The market structure where there are many sugarcane farmers selling their produce to only a few sugar mills in a designated area is known as:
(A) Oligopsony
(B) Monopoly
(C) Oligopoly
(D) Perfect competition

52. Select the correct economic sequence of the sugarcane supply chain in Uttar Pradesh:
(A) Harvesting → Cane Society Purchi Generation → Mill Weighbridge → Payment to Farmer
(B) Cane Society Purchi Generation → Harvesting → Mill Weighbridge → Payment to Farmer
(C) Mill Weighbridge → Harvesting → Payment to Farmer → Cane Society Purchi Generation
(D) Payment to Farmer → Cane Society Purchi Generation → Harvesting → Mill Weighbridge

53. Which of the following is classified as a capital asset in farm economics?
(A) A combined harvester owned by the farmer
(B) Urea fertilizer used in the current season
(C) Electricity consumed for pumping water
(D) Seed cane purchased for planting

54. Which region of Uttar Pradesh is traditionally recognized as the most dominant contributor to the state's sugarcane and sugar economy due to high acreage and recovery rates?
(A) Bundelkhand Region
(B) Vindhya Region
(C) Eastern Uttar Pradesh
(D) Western Uttar Pradesh

55. Consider the following statements regarding the multiplier effect of sugarcane payments in the rural economy:
I. Timely payment of cane dues increases the disposable income of farmers.
II. Higher disposable income suppresses the local demand for consumer goods.
III. Increased farmer spending stimulates growth in local retail and service sectors.
Which of the above statements is/are correct?
(A) I and II only
(B) II and III only
(C) I and III only
(D) I, II and III

56. The Principle of Product Substitution helps a farmer answer which of the following basic economic questions?
(A) How to produce?
(B) When to produce?
(C) What to produce?
(D) Where to sell?

57. The primary objective of the Sugarcane Development Councils (Ganna Vikas Parishad) in the economic framework of Uttar Pradesh is to:
(A) Fix and regulate the official retail price of refined sugar in local consumer markets
(B) Direct export of processed sugar to international global trading markets
(C) Manufacture heavy farm agricultural machinery and industrial tractors
(D) Facilitate cane development activities like

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agricultural projects rests with the State Level Sanctioning Committee. In Uttar Pradesh, as in other states, this high-powered sanctioning committee is officially chaired by the Chief Secretary of the State Government.

70. (C) To incentivize States to increase public investment in agriculture and allied sectors
The Rashtriya Krishi Vikas Yojana was established to incentivize states to allocate higher public expenditure toward agriculture and allied sectors. By granting financial flexibility and autonomy to states to execute tailored district agricultural plans, the scheme promotes sustainable growth, infrastructure development, and improved productivity across diverse farming regions.

71. (C) 3 percent per annum
Under the Agriculture Infrastructure Fund, financial institutions provide term loans to eligible entities for creating post-harvest management infrastructure and community farming assets. All loans disbursed under this facility carry an interest subvention benefit of three percent per annum on borrowing amounts up to a limit of two crore rupees.

72. (A) PMKVY - Short-term skill training and certification
The Pradhan Mantri Kaushal Vikas Yojana is a flagship skill training scheme under the Skill India Mission. It focuses on offering short-term industry-relevant skill training, assessing prior learning competencies, and certifying youth across diverse technical and operational trades to enhance employability across both rural and urban workforce sectors.

73. (B) Paramparagat Krishi Vikas Yojana (PKVY)
The Bharatiya Prakritik Krishi Paddhati is implemented as a dedicated sub-scheme under the Paramparagat Krishi Vikas Yojana. It emphasizes natural farming techniques, eliminating synthetic external inputs, and promoting on-farm biomass recycling, cow-dung and urine-based formulations, and traditional ecological practices to maintain soil fertility and reduce cultivation costs.

74. (B) They can check their cane survey data, quota, and supply slips online
The E-Ganna mobile application serves as a dedicated digital utility for sugarcane growers across Uttar Pradesh. It provides direct, real-time access to personalized cane survey data, supply quotas, issued weighment slips, and calendar details, eliminating administrative delays and bringing complete transparency to the sugarcane supply chain.

75. (A) Both Statement I and Statement II are correct
The SHG-Bank Linkage Programme was originally conceptualized and piloted by NABARD to integrate informal self-help groups with institutional banking. It permits informal savings groups of poor women to open bank savings accounts without upfront legal status and gain access to collateral-free credit, underpinning the foundation of DAY-NRLM.

76. (C) e-Chhawani Portal
While Kisan Suvidha App, e-NAM Portal, and FARMS App provide essential agricultural services, market prices, and equipment rental support to farmers, the e-Chhawani portal is designed specifically for civic services in cantonment board areas under the Ministry of Defence, making it unrelated to agricultural or farmer welfare activities.

77. (D) Swarnajayanti Gram Swarozgar Yojana (SGSY)
The Deendayal Antyodaya Yojana - National Rural Livelihoods Mission was launched by restructuring the earlier Swarnajayanti Gram Swarozgar Yojana. The redesign shifted the strategic focus from individual capital subsidies to building strong, sustainable, community-driven institutions like Self Help Groups to alleviate rural poverty through diversified livelihood security.

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78. (C) 12
A standard Soil Health Card evaluates twelve key soil parameters to guide balanced fertilizer usage. These parameters comprise primary nutrients (Nitrogen, Phosphorus, Potassium), secondary nutrient (Sulphur), micro-nutrients (Zinc, Iron, Copper, Manganese, Boron), and physical status indicators (pH, Electrical Conductivity, Organic Carbon), delivering a complete profile of soil health.

(C) Subtracting total state expenditure from total state income
(D) Dividing the agricultural GDP by the rural population

68. The issue of cane price arrears in the sugar economy negatively impacts the rural sector primarily by:
(A) Increasing the inflation rate of industrial goods
(B) Overcapitalizing the cooperative banking sector
(C) Disrupting the cash flow and purchasing power of the farmers
(D) Immediately increasing the retail price of sugar in global markets

69. Given below are two statements, one labelled as Assertion (A) and the other as Reason (R):
Assertion (A): Crop diversification is an important economic strategy for achieving agricultural growth.
Reason (R): Relying on a single crop exposes farmers to high market price volatility and biological risks.
Which of the following is correct?
(A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
(B) Both Assertion (A) and Reason (R) are true but R is not the correct explanation of A.
(C) Assertion (A) is true but Reason (R) is false.
(D) Assertion (A) is false but Reason (R) is true.

70. In calculating the State Gross Domestic Product, the Gross Value Added (GVA) of the agriculture sector is computed as:
(A) Total gross value of sector output plus state agricultural subsidies
(B) Total intermediate consumption expenditure minus direct indirect taxes
(C) Total aggregate value of state exports minus total value of imports
(D) Gross value of output minus intermediate consumption

71. The expansion of agro-based industries directly prevents which economic problem in rural areas?
(A) Over-mechanization of small farms
(B) Rural-to-urban distress migration
(C) Excessive foreign exchange reserves
(D) Over-reliance on modern irrigation techniques

72. Arrange the following steps of the economic farm planning process in the correct sequence:
1. Identifying problems and objectives
2. Identifying available resources
3. Formulation of the farm plan
4. Execution of the plan
Select the correct code:
(A) 1, 2, 3, 4
(B) 2, 1, 4, 3
(C) 1, 3, 2, 4
(D) 3, 1, 2, 4

73. Which apex state-level cooperative body plays a major role in the economic management of cooperative sugar mills in Uttar Pradesh?
(A) Uttar Pradesh Industrial Cooperative Association (UPICA)
(B) Uttar Pradesh State Agro Industrial Corporation (UP Agro)
(C) Uttar Pradesh State Agricultural Produce Market Board (Mandi Parishad)
(D) UP Cooperative Sugar Factories Federation

74. Which national financial institution is the apex body for providing refinance and guiding credit planning to boost the rural and agricultural economy in states like Uttar Pradesh?
(A) National Bank for Agriculture and Rural Development
(B) Reserve Bank of India Central Monetary Authority (RBI)
(C) State Bank of India Commercial Banking Corporation (SBI)
(D) Small Industries Development Bank of India Principal Financial Institution (SIDBI)

75. In agricultural economics, an isoquant curve representing the combination of two variable inputs to produce a given level of output is typically:
(A) Concave to the origin
(B) Convex to the origin
(C) A vertical straight line
(D) Upward sloping to the right

76. Indirect employment generated by the sugarcane industry includes all of the following EXCEPT:
(A) Independent tractor trolley owners transporting cane to processing mills
(B) Full-time boiler operators employed inside sugar mills
(C) Seasonal migrant agricultural laborers hired for cane harvesting operations
(D) Local independent mechanics repairing

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specialized farm tractor machinery

77. The economic principle of substitution between two inputs (Factor-Factor relationship) is primarily used to determine:
(A) The least-cost combination of inputs
(B) What to produce
(C) When to sell the output
(D) The maximum possible price of the output

78. Match List I with List II and select the correct option:
List I: (Economic Instrument)
P. Minimum Support Price (MSP)
Q. Crop Insurance
R. Subsidized Credit
S. e-NAM
List II: (Objective in Agriculture)
1. Risk mitigation against crop failure
2. Floor price assurance to farmers
3. Unified national agricultural market
4. Lowering the cost of capital investment
(A) P-2, Q-1, R-4, S-3
(B) P-1, Q-2, R-3, S-4
(C) P-2, Q-4, R-1, S-3
(D) P-3, Q-1, R-4, S-2

79. Precision agriculture techniques adopted by agri-tech startups contribute to the agricultural economy by:
(A) Significantly increasing blanket application of chemical fertilizers to maximize farm yield at any cost
(B) Completely replacing commercial cash crops with traditional subsistence farming systems
(C) Mandating that strictly manual physical labor is used across all farm agricultural operations
(D) Optimizing input use to reduce production costs and environmental impact

80. While analyzing agricultural exports contributing to the national economy, which of the following products from Uttar Pradesh holds a prominent share in the export market?
(A) Coffee
(B) Marine products
(C) Basmati Rice
(D) Black Pepper

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ANSWERS

1. (B) 2027-28
The Government of Uttar Pradesh has established a target to transform the state's economy into a One Trillion Dollar economy by the financial year 2027-28. Achieving this ambitious goal requires rapid growth across key economic drivers, including agriculture, industrial manufacturing, infrastructure expansion, and service sectors, alongside significant policy support and investment attraction.

2. (B) Stage II, where marginal product is decreasing but positive
In classical production economics, Stage II is known as the rational zone of production. Throughout this stage, the marginal product is decreasing but remains positive, while the average product is declining. A rational producer always operates within Stage II because total physical output continues to increase, allowing optimal input allocation and maximum profit potential.

3. (C) 24 to 26 percent
Agriculture and allied activities constitute the backbone of Uttar Pradesh's economy, contributing approximately 24 to 26 percent to the Gross State Value Added (GSVA). This vital contribution sustains a major portion of the rural population, ensures state food security, supplies industrial raw materials, and serves as a foundational pillar for regional economic expansion.

4. (A) I and II only
Sugarcane processing is the primary agro-based industry in Uttar Pradesh, providing economic sustenance to over 50 lakh farming families. However, the industry generates substantial tax revenues and state excise earnings through sugar sales, ethanol production, and molasses utilization, making the assertion of negligible revenue contribution entirely incorrect in state fiscal context.

5. (C) Greater than one
The Benefit-Cost Ratio (BCR) is a standard investment evaluation metric computed by dividing the present discounted value of expected benefits by the present discounted value of costs. An agricultural project is considered economically viable when its BCR is greater than one, indicating that total discounted returns exceed total discounted financial inputs.

6. (D) Synergy and convergence of Central Government and State Government schemes
The double-engine governance model relies on structural coordination, policy synchronization, and financial convergence between Central and State Governments. By aligning national development programs with state-specific priorities, this mechanism optimizes resource allocation, eliminates administrative friction, accelerates rural infrastructure development, and enhances overall economic outcome efficiency across primary agricultural sectors in rural areas.

7. (C) Relatively inelastic
Basic agricultural food commodities represent essential human dietary necessities that lack direct close substitutes. Consequently, consumer demand for these products remains relatively inelastic with respect to price changes. Price drops or surges result in proportionally smaller fluctuations in total quantity demanded, as household consumption patterns stay stable regardless of short-term market shifts.

8. (C) Molasses
Molasses is a viscous sugar refinery byproduct generated during sugarcane processing. Under the National Policy on Biofuels, molasses serves as the primary feedstock for bio-ethanol distillation. Its utilization in the ethanol blending program provides sugar mills with crucial extra revenue streams, stabilizes industry finances, and supports sustainable green energy transition objectives nation-wide.

9. (A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
Public investments in foundational agricultural infrastructure, such as canal networks and rural transport routes, significantly lower transaction overheads and production risks. This reduction in overhead improves farm profitability, thereby crowding in private capital investments by

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29. (A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
During peak harvest periods, market supply increases rapidly due to crop perishability and limited farm storage capacity. Because consumer demand for basic agricultural outputs is price inelastic, market clearing requires a steep decline in price. Hence, inelastic demand explains why post-harvest supply gluts cause disproportionate price crashes for primary agricultural produce.

30. (C) Technical efficiency and Allocative efficiency
Economic efficiency in agricultural production requires achieving both technical and allocative efficiency. Technical efficiency occurs when a farm produces maximum physical output from a given set of inputs. Allocative efficiency occurs when inputs are combined in proportions that minimize costs based on prevailing factor prices, maximizing overall farm profitability.

31. (D) Primary Sector
The primary sector encompasses economic activities that directly harvest, extract, or exploit natural resources. Sugarcane cultivation involves growing and harvesting agricultural plants from land and soil resources, placing it squarely within the primary sector, whereas industrial sugar processing belongs to the secondary sector and retail distribution to the tertiary service sector.

32. (C) Net addition to physical farm capital stock over a period
Capital formation in agriculture refers to the net addition of durable physical capital assets to the farming sector over a specific period. This includes investments in land development, micro-irrigation facilities, modern machinery, storage structures, and farm roads, which systematically expand operational capacity and enhance long-term overall state agricultural productivity.

33. (A) I and II only
Cost-benefit analysis systematically evaluates expected revenues against project costs to determine financial and economic feasibility. It serves as a vital decision-making framework for farm investments like installing drip irrigation. Proper cost-benefit evaluations incorporate discounted cash flows, explicitly recognizing the time value of money, which refutes claims that it ignores temporal discounting.

34. (D) Organic manure for soil fertility
Press mud, or filter cake, is an organic residue left after raw sugarcane juice filtration in sugar mills. Rich in organic carbon, nitrogen, phosphorus, and micro-nutrients, press mud is widely utilized directly or after composting as a soil conditioner and bio-fertilizer to enhance overall soil health and organic matter content.

35. (A) Law of Diminishing Marginal Utility
The Law of Diminishing Marginal Utility states that as a consumer increases the consumption of a specific good, the additional satisfaction or utility derived from each successive unit decreases. This foundational microeconomic principle explains consumer demand curves and downward-sloping marginal valuation across agricultural commodity markets and retail consumer product exchanges.

36. (C) Marginal Revenue equals Marginal Cost (MR = MC)
In production economics, profit maximization occurs at the input level where Marginal Revenue equals Marginal Cost (MR = MC). Beyond this point, producing an additional unit costs more than the revenue it generates, reducing total net profit. Consequently, MR = MC represents the definitive economic decision condition for profit-maximizing farm production.

37. (B) 9
For decentralized agricultural planning and crop suitability management, Uttar Pradesh is categorized into nine distinct Agro-Climatic Zones based on variations in soil types, rainfall patterns, temperature ranges, and topographical features. This classification helps tailor regional cropping systems, irrigation policies, extension services, and agricultural investments to specific local agro-ecological realities.

38. (A) P-3, Q-1, R-4, S-2
Cost concepts categorize operational expenditures in farm management. Fixed costs remain constant regardless of production output in the short run. Variable costs vary directly with output volume. Marginal cost is the additional expenditure required to produce one extra output unit, while total cost represents the aggregate sum of fixed and variable costs.

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Government fixes the FRP based on statutory recommendations submitted by the Commission for Agricultural Costs and Prices (CACP) after evaluating cost of production, market trends, and sugarcane sugar recovery rates.

20. (C) Change in total output from using one additional unit of variable input
Marginal Product represents the change in total physical output resulting from a one-unit increase in the application of a variable input, assuming all other inputs remain constant. It measures the physical productivity added by incremental factor units and serves as a fundamental metric for economic output analysis in agricultural production economics.

21. (A) Agriculture and Allied Sectors
Agriculture and allied activities form the primary economic structure in Uttar Pradesh, providing direct and indirect employment to a major share of the rural workforce. The sector supports livelihood security, supplies raw materials for major industries, and underpins rural demand, making it essential for inclusive regional aggregate economic development.

22. (B) III only
Strategies aimed at expanding the state's economy rely on multi-sectoral growth where public investment in agriculture plays a fundamental role. Shifting public investment entirely away from agriculture would severely damage primary sector productivity, rural livelihoods, and supply chain stability, making such a policy shift counterproductive and highly economically incorrect.

23. (B) Are decentralized and labor-intensive, providing local employment
Traditional Gur and Khandsari manufacturing units operate as decentralized, labor-intensive village processing industries in sugarcane-growing regions. By absorbing local agricultural produce and providing non-farm rural employment opportunities, these processing units play a key role in supplementing farm incomes, generating localized employment, and sustaining the state's broader rural micro-economy.

24. (C) APEDA
The Agricultural and Processed Food Products Export Development Authority (APEDA) is the statutory national body under the Ministry of Commerce and Industry responsible for promoting agricultural export trade. APEDA facilitates trade infrastructure, ensures quality compliance, and establishes international market access, thereby linking domestic producers to global agricultural commodity markets.

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25. (D) Direct employment of technicians, engineers, and mill workers
Direct employment in the sugar industry encompasses formal, salary-earning positions created within industrial processing facilities. This includes factory technicians, mechanical engineers, administrative personnel, and mill operations workers. These roles differ from indirect employment, which comprises external activities like independent sugarcane harvesting, third-party transport logistics, and off-site agricultural machinery repair.

26. (A) Total revenue equals total cost
The Break-Even Point in farm business management is the operational output volume at which total generated revenue exactly equals total incurred costs. At this equilibrium level, the production enterprise realizes zero economic profit and suffers zero financial loss, marking the minimum threshold needed to cover all fixed and variable operating expenses.

27. (B) Limited capital to allocate among competing enterprises
The Principle of Equi-Marginal Returns dictates that limited capital or resources should be allocated across alternative farm enterprises such that the marginal returns from the last unit of input are equal in all uses. This economic principle ensures maximum total returns when resources are constrained and capital allocation choices must be optimized.

28. (B) Sugarcane farmers and sugar mills for transparent cane supply
Cooperative Cane Development Societies function as grass-root economic intermediaries linking sugarcane growers and processing mills. They coordinate cane supply schedules, issue official supply passes, organize transportation, distribute agricultural inputs, and verify accurate weighbridge measurements, thereby ensuring structured, transparent procurement operations and protecting small and marginal farmers' vital commercial economic interests.

farmers into modern implements, machinery, and quality inputs, confirming that public capital directly stimulates private agricultural investment.

10. (A) Opportunity cost
Opportunity cost represents the value of the foregone revenue or benefit from the next best alternative choice when making an economic decision. When a farmer allocates farmland to sugarcane cultivation, the lost potential net return from growing wheat instead constitutes the opportunity cost associated with selecting sugarcane over wheat crop production.

11. (B) Increasing the shelf life, utility, and market value of primary produce
Agricultural value-chain development integrates organized supply chain activities ranging from post-harvest handling, sorting, and grading to processing and commercial packaging. These value-adding processes enhance overall product quality, extend shelf life, and increase economic utility. By converting raw farm produce into higher-value outputs, producers capture superior profit margins and spur rural growth.

12. (B) MP is increasing, MP is decreasing but positive, MP is negative
The classical production function is structured into three distinct stages based on marginal productivity behavior. In Stage I, Marginal Product increases until reaching its maximum. In Stage II, Marginal Product decreases while remaining positive until it reaches zero. In Stage III, Marginal Product becomes negative, causing total physical product to decline.

13. (A) Land revenue and permanent lease rent
Fixed costs in agricultural operations remain constant in the short run regardless of output levels. Land revenue payments, local property taxes, and long-term lease rent must be paid irrespective of total crop harvested or cultivated area decisions. In contrast, expenditures on fertilizers, fuel, and casual labor fluctuate directly with production activity levels.

14. (C) Promoting crop diversification, agro-processing, and agricultural exports
Achieving the state's ambitious trillion-dollar economic objective requires structural modernization of the primary sector. Strategic emphasis focuses on promoting high-value crop diversification, expanding food processing infrastructure, enhancing agricultural export competitiveness, and establishing sustainable agri-enterprises, rather than relying solely on low-margin traditional cereal production or uncoordinated traditional rural farming methods across districts.

15. (C) I and III only
Agricultural supply exhibits inelastic behavior in the short run due to biological growth cycles and natural production delays, preventing immediate supply adjustments to market price movements. Consequently, a sudden market glut following a bumper harvest causes severe price drops, making supply rigidity and price sensitivity key characteristics of agricultural product markets.

16. (A) First
Uttar Pradesh holds the top position nationwide in both sugarcane production and overall sugar output. Favorable agro-climatic conditions, vast fertile alluvial soils, extensive canal networks, and a high density of processing mills contribute to the state's leadership, rendering the sugar industry a vital driver of the broad state regional agricultural economy.

17. (B) Decline
The Law of Diminishing Marginal Returns states that when successive increments of a variable factor are applied to a fixed amount of land, total output increases at a decreasing rate beyond a certain point. Consequently, the additional output generated per unit of variable input eventually declines due to factor proportions imbalance.

18. (A) P-3, Q-2, R-1, S-4
Economic production principles address distinct farm management decisions. Factor-Product relationship guides how much output to produce to maximize profits. Factor-Factor relationship determines the least-cost combination of inputs. Product-Product relationship resolves what combination of enterprises to produce, while time comparison principles govern optimal timing for buying, selling, and future resource transactions.

19. (A) Commission for Agricultural Costs and Prices (CACP)
The Fair and Remunerative Price (FRP) is the statutory minimum price that sugar mills must pay to sugarcane growers. The Central

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39. (B) Precision farming, logistics, and agri-fintech
In Uttar Pradesh, emerging agri-tech start-ups focus primarily on modernizing agricultural supply chains through precision farming technologies, IoT-driven farm advisory services, efficient logistics platforms, and agri-fintech solutions. These innovations optimize resource efficiency, improve market access, reduce post-harvest losses, and enhance commercial profit margins for small and marginal landholders across rural regions.

40. (C) The State Government
The State Advised Price (SAP) for sugarcane in Uttar Pradesh is determined and officially announced by the State Government under powers provided by state statutory regulations. The SAP is typically set higher than the Central Government's Fair and Remunerative Price to safeguard growers' financial interests and reflect regional agricultural production costs.

41. (D) Government construction of canal irrigation network
Public investment in agriculture consists of capital investments funded directly by state and central governments to establish shared social and economic infrastructure. Government construction of canal irrigation networks represents a classic public investment that provides long-term, non-excludable agricultural benefits, boosting productivity across farming communities, unlike individual private capital equipment spending.

42. (B) I, II and III only
Boosting agricultural Gross Domestic Product requires strategies that enhance productivity and farm income. Increasing irrigation efficiency, raising seed replacement rates, and expanding farm mechanization drive yield growth and operational efficiency. Conversely, reducing Minimum Support Prices systematically undermines price security and farmer revenues, making it counterproductive to state economic expansion goals.

43. (C) Between 0 and 1
Stage II of the classical agricultural production function begins where Average Physical Product reaches its maximum and ends where Marginal Physical Product drops to zero. Consequently, the elasticity of production throughout this rational zone of output lies strictly between zero and one, reflecting diminishing but positive returns to applied variable inputs.

44. (B) Agriculture and Allied Sectors
Agriculture and allied sectors continue to absorb the largest share of the labor force in Uttar Pradesh. Rural household livelihoods remain heavily dependent on crop cultivation, animal husbandry, agricultural labor, and primary commodity processing, making agriculture the principal source of employment and wage income across the entire state economy.

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45. (C) 20%
The Government of India set a target of achieving 20 percent ethanol blending in petrol by the supply year 2025-26 under the Ethanol Blended Petrol (EBP) Program. This target expands bio-ethanol production from sugarcane juice, B-heavy molasses, and C-heavy molasses, strengthening mill liquidity and providing guaranteed market demand for sugarcane growers.

46. (C) Price of the product (output)
The Value of Marginal Product (VMP) measures the monetary revenue generated by employing one extra unit of a variable factor. It is calculated by multiplying the Marginal Physical Product (the incremental physical output) by the market price of the output product. Profit maximization is achieved where VMP equals unit factor price.

47. (D) Comparative Advantage
The Principle of Comparative Advantage directs resource allocation toward enterprises that yield the highest relative net economic returns. A farmer selecting between sugarcane and wheat evaluates opportunity costs and comparative profit margins per unit land, choosing the crop enterprise that yields superior net income given local soil, climate, and market conditions.

48. (C) Higher sugar output from same quantity of crushed cane
Sugar recovery percentage reflects the quantity of commercial sugar extracted per unit weight of sugarcane processed. An increase in recovery percentage means sugar mills extract more marketable sugar from the exact same physical volume of crushed cane, directly lowering unit operational costs and boosting mill profitability without requiring additional raw material tonnage.

purchase essential inputs for upcoming crop seasons, settle institutional debts, and meet household operational expenses, thereby depressing overall purchasing power and economic activity throughout rural market centers.

69. (A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
Crop diversification involves cultivating multiple crop varieties rather than relying on monoculture. Single-crop farming exposes producers to severe yield losses from pest outbreaks, adverse weather, and price volatility. Diversification spreads climate and market risks across multiple enterprises, stabilizing farm incomes and supporting long-term economic sustainability in regional agricultural systems.

70. (D) Gross value of output minus intermediate consumption
In state economic accounting, Gross Value Added (GVA) for the agriculture sector measures the net economic contribution of agricultural activities. It is computed as the total gross monetary value of agricultural output generated minus the value of intermediate consumption expenditure (inputs like seeds, fertilizers, pesticides, electricity, and fuel utilized during production).

71. (B) Rural-to-urban distress migration
Expanding agro-based industries in rural regions creates local off-farm employment in processing, packaging, and logistics. By generating sustainable non-farm employment opportunities near agricultural production hubs, rural enterprise growth absorbs surplus agricultural labor, increases local household earnings, and directly reduces distress migration from rural areas to urban industrial commercial market centers.

72. (A) 1, 2, 3, 4
Systematic farm planning follows a sequential problem-solving process. The process begins with identifying farm objectives and operational constraints, followed by assessing available land, labor, and capital resources. Next, alternative farm plans are formulated to determine resource allocation, culminating in the execution and monitoring of the selected optimal farm plan.

73. (D) UP Cooperative Sugar Factories Federation
The Uttar Pradesh Cooperative Sugar Factories Federation (UP Cooperative Sugar Federation) is the apex cooperative body managing and coordinating cooperative sector sugar mills across the state. It oversees operational management, technical support, sugar marketing, policy enforcement, and financial administration for member cooperative sugar factories located in Uttar Pradesh.

74. (A) National Bank for Agriculture and Rural Development
The National Bank for Agriculture and Rural Development (NABARD) is the statutory apex development financial institution in India. NABARD formulates credit policies, provides refinance facilities to regional rural banks and cooperative institutions, finances rural infrastructure, and promotes institutional credit delivery to expand agricultural productivity and rural regional economic growth.

75. (B) Convex to the origin
An isoquant curve illustrates all combinations of two variable inputs that yield a constant physical output level. Because variable inputs substitute for one another at a diminishing marginal rate (Diminishing Marginal Rate of Technical Substitution), isoquants exhibit a smooth convex shape relative to the origin in standard production economics graphs.

76. (B) Full-time boiler operators employed inside sugar mills
Direct employment refers to workers hired under formal wage contracts within processing plants, such as full-time boiler operators employed inside sugar mills. Indirect employment comprises ancillary, seasonal, or independent self-employed positions created across supply chains, including tractor operators, seasonal harvest labor crews, and local agricultural equipment repair mechanics.

77. (A) The least-cost combination of inputs
The economic principle of factor substitution evaluates factor-factor relationships to determine how to combine two variable inputs to minimize production costs for a given output target. By equating the Marginal Rate of Technical Substitution to the factor price ratio, farmers identify the least-cost input combination, optimizing overall cost efficiency.

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ethanol distillation. Press mud is processed into organic bio-compost manure, while cane tops are utilized as livestock green fodder.

59. (B) Marginal Farmer
Under official land holding classifications in India, agricultural operational holdings are categorized based on land area. A farmer operating an landholding of less than 1.0 hectare (2.47 acres) is classified as a marginal farmer, whereas those operating between 1.0 and 2.0 hectares are designated as small agricultural farmers.

60. (B) Partial Budgeting
Partial budgeting is a specialized farm management decision-making tool used to evaluate the economic impact of minor operational changes in farm organization. When comparing a minor practice shift, such as switching from a standard sugarcane variety to an early-maturing high-sugar variety, partial budgeting calculates net changes in returns by analyzing added costs, reduced costs, added revenues, and reduced revenues.

61. (A) Increase the quantity of fertilizer supplied
According to the economic Law of Supply, assuming other factors remain constant, there exists a direct positive relationship between product price and quantity supplied. If manufacturers anticipate higher market selling prices for fertilizer in upcoming periods, market incentives encourage them to expand production and increase the total quantity of fertilizer supplied to capture higher profits.

62. (C) Rectangular hyperbola
Average Fixed Cost (AFC) is computed by dividing total fixed cost by the total quantity of output produced. Because total fixed cost remains constant while production volume increases, AFC decreases continuously as output expands, approaching both axes asymptotically without ever touching them, which mathematically forms a rectangular hyperbola shape curve.

63. (D) Regulate equitable and timely supply of cane to sugar mills
The ticketing system (Purchi) operated under the Sugarcane Regulation Act is a regulatory mechanism designed to manage the orderly harvest and supply of cane to sugar processing plants. It prevents market gluts, ensures equitable harvesting schedules for small landholders, minimizes post-harvest deterioration, and guarantees structured, transparent raw material delivery to mills.

64. (A) I, II and IV only
Uttar Pradesh possesses major structural agricultural advantages, holding national top ranks in total wheat acreage, potato output, and milk production. The state benefits from rich Indo-Gangetic alluvial plains and extensive river systems. However, statement III is false because over 90 percent of operational landholdings belong to marginal and small farmers, not large farmers.

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65. (B) Price ratio of input and product (P_x/P_y)
In production economics, optimal input allocation for maximum profit occurs where Marginal Physical Product (MPP) equals the input-to-product price ratio (P_x / P_y). Alternatively expressed as Value of Marginal Product equaling input price (VMP = P_x), this equilibrium condition dictates the precise level of variable factor usage required to maximize net returns.

66. (C) 100th year (2047)
The phrase "Amrit Kaal" refers to the 25-year period leading up to the centenary of Indian independence in 2047 (spanning from 2022 to 2047). During this transformative developmental era, national and state economic policies aim to achieve rapid economic growth, comprehensive infrastructure expansion, technological advancement, and long-term socio-economic prosperity across all productive economic sectors.

67. (A) Dividing the total state income by its total population
Per capita state income is a standard macroeconomic metric used to measure average economic output per person. It is calculated by dividing the total Gross State Domestic Product (or total state net income) by the state's total mid-year population. This indicator reflects general economic productivity and standard of living trends within a regional economy.

68. (C) Disrupting the cash flow and purchasing power of the farmers
Delays in sugarcane price payments create cane price arrears, which severely constrain farm working capital and rural household liquidity. Delayed payments impair farmers' ability to

49. (A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
Operating in Stage I of the production function is economically irrational because Marginal Product exceeds Average Product throughout this phase, meaning Average Product is still increasing. Adding variable inputs continuously enhances average factor productivity, so a producer can increase output efficiency and net economic returns by expanding input usage beyond Stage I into Stage II.

50. (D) Agri-Clinics and Agri-Business Centres Scheme
The Agri-Clinics and Agri-Business Centres (ACABC) scheme was launched to promote agri-entrepreneurship among qualified agricultural graduates. Implemented through NABARD and MANAGE, it provides specialized entrepreneurship training and credit-linked financial support to enable graduates to establish commercial agri-ventures, offering fee-for-service expert extension and business advisory support to farming communities across states.

51. (A) Oligopsony
An oligopsony is a market structure defined by the presence of a vast number of sellers (sugarcane farmers) and only a few dominant buyers (sugar mills) within a regional market area. Because sugar mills represent the few purchasing outlets for perishable cane, they possess significant buyer market power over local cane transactions.

52. (B) Cane Society Purchi Generation → Harvesting → Mill Weighbridge → Payment to Farmer
The operational sequence of the sugarcane supply chain in Uttar Pradesh follows a structured economic workflow. First, Cooperative Cane Societies issue official supply permits (Purchi). Farmers then harvest cane according to ticket schedules, deliver produce to mill weighbridges for accurate weighing, and finally receive payment through institutional banking channels following processing verification.

53. (A) A combined harvester owned by the farmer
Capital assets in farm economics are durable goods used repeatedly in agricultural production over multiple operational cycles without being exhausted in a single season. A combined harvester represents fixed capital investment providing operational service over many years, unlike variable inputs like seed, fertilizer, or electricity, which are fully consumed in one production cycle.

54. (D) Western Uttar Pradesh
Western Uttar Pradesh is recognized as the sugar bowl of the state due to its dominant contribution to sugarcane acreage, total production, and processing capacity. Fertile soils, high irrigation coverage, favorable climatic factors, and established sugar mill clusters yield higher crop productivity and sugar recovery rates compared to other administrative regions.

55. (C) I and III only
Timely clearance of sugarcane dues injects liquidity directly into rural households, raising farmers' disposable income. Higher disposable income stimulates consumer spending on retail goods, farm inputs, health, and education, generating a positive multiplier effect across the local economy. Suppressing retail demand is counterfactual, making statement II incorrect while statements I and III are valid.

56. (C) What to produce?
The Principle of Product Substitution governs product-product relationships, helping farmers determine what combination of enterprises or crops to produce using a given set of farm resources. It analyzes marginal rate of product substitution against product price ratios to select enterprise combinations that maximize total gross margin from fixed agricultural operational resources.

57. (D) Facilitate cane development activities like seeds and soil testing
Sugarcane Development Councils (Ganna Vikas Parishads) are local institutional entities established to oversee agricultural field activities in sugar factory command areas. Their primary objective is to promote sugarcane development by distributing certified seed cane, conducting soil health testing, managing biological pest control programs, and training farmers in modern agronomic cultivation practices.

58. (A) P-2, Q-3, R-4, S-1
Sugarcane processing generates distinct valuable by-products with specific industrial uses. Bagasse is burned as biofuel for co-generation of thermal steam and electricity. Molasses serves as primary raw material for industrial alcohol and bio-

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78. (A) P-2, Q-1, R-4, S-3
Economic instruments serve targeted agricultural objectives. Minimum Support Prices (MSP) provide floor price assurances to farmers against distress sales. Crop insurance provides risk mitigation against crop failure. Subsidized credit lowers capital investment costs, while the National Agriculture Market (e-NAM) establishes a unified nationwide electronic trading platform for transparent produce marketing.

79. (D) Optimizing input use to reduce production costs and environmental impact
Precision agriculture utilizes GPS mapping, sensor technologies, satellite imaging, and target-rate variable application to optimize agricultural inputs such as water, seed, and fertilizer. By targeting field application precisely, agri-tech platforms minimize input waste, reduce per-hectare operating costs, minimize environmental degradation, and enhance net crop enterprise yield profitability.

80. (C) Basmati Rice
Basmati Rice is a major agricultural export commodity from Uttar Pradesh, contributing significantly to India's agricultural export trade. Several agro-climatic districts in Uttar Pradesh are officially recognized as Geographical Indication (GI) zones for aromatic Basmati Rice production, earning substantial foreign exchange reserves and integrating regional farmers into global commodity markets.

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a scheme designed under which major central programme?
(A) Pradhan Mantri Fasal Bima Yojana (PMFBY)
(B) Rashtriya Krishi Vikas Yojana (RKVY)
(C) National Food Security Mission (NFSM)
(D) Pradhan Mantri Kisan Samman Nidhi (PM-KISAN)

64. In agricultural infrastructure PPP projects (like modern grain silos), 'Viability Gap Funding' (VGF) refers to:
(A) A comprehensive tax refund provided by state governments to private corporate entities participating in infrastructure projects
(B) A mandatory financial penalty levied on private construction contractors for failing to complete public infrastructure projects on schedule
(C) A subsidized low-interest credit facility extended exclusively to local farmers to purchase equity shares in private partnership ventures
(D) A capital grant by the government to make essential projects commercially viable

65. Given below are two statements, one labelled as Assertion (A) and the other as Reason (R):
Assertion (A): The promotion of Agri-Clinics and Agri-Business Centres (ACABC) scheme is a successful example of the Public-Private Partnership model in agricultural extension services.
Reason (R): It utilizes the expertise of unemployed agricultural graduates to provide paid expert services and inputs to farmers, thereby supplementing the public extension system.
In the context of the above statements, select the correct answer from the options given below:
(A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
(B) Both Assertion (A) and Reason (R) are true but R is not the correct explanation of A.
(C) Assertion (A) is true but Reason (R) is false.
(D) Assertion (A) is false but Reason (R) is true.

66. The Fair and Remunerative Price (FRP) of sugarcane is announced by the Central Government on the recommendation of which body?
(A) Indian Institute of Sugarcane Research (IISR), Lucknow
(B) NITI Aayog Governing Council
(C) Commission for Agricultural Costs and Prices (CACP)
(D) Reserve Bank of India (RBI)

67. The Sugarcane (Control) Order, which provides the statutory framework for fixing the FRP of sugarcane and regulating its supply, was issued under which Act?
(A) The Essential Commodities Act, 1955
(B) The Agricultural Produce Market Committee Act, 2003
(C) The Epidemic Diseases Act, 1897
(D) The National Food Security Act, 2013

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68. State Advised Price (SAP) for sugarcane, declared by states like Uttar Pradesh, is generally:
(A) Lower than the centrally declared FRP
(B) Exactly equal to the centrally declared FRP
(C) Not applicable to private sugar mills
(D) Higher than the centrally declared FRP

69. Consider the following factors:
I. Cost of production of sugarcane
II. Return to the growers from alternative crops and the general trend of prices of agricultural commodities
III. Recovery rate of sugar from sugarcane
IV. Price at which sugar produced from sugarcane is sold by sugar producers
Which of the above factors are considered by the CACP while recommending the Fair and Remunerative Price (FRP) for sugarcane?
(A) I, II and III
(B) I, III and IV
(C) II, III and IV
(D) I, II, III and IV

70. Which high-level committee recommended a 'Revenue Sharing Formula' for sugarcane pricing, suggesting that farmers be paid a specific percentage of the realization from sugar and its by-products?
(A) Swaminathan Commission
(B) Dalwai Committee
(C) Rangarajan Committee
(D) Shanta Kumar Committee

71. In Uttar Pradesh, under the Sugarcane (Regulation of Supply and Purchase) Act, 1953, the authority to declare and delineate the 'Reserved Area' for a sugar mill lies with the:
(A) District Magistrate
(B) Central Agriculture Minister

IV. Digitalization of land records under Bhulekh has reduced rural land disputes.

Which of the above statements are correct?
(A) I, II and IV
(B) I, III and IV
(C) II, III and IV
(D) I, II, III and IV

9. As per the Priority Sector Lending (PSL) norms set by the Reserve Bank of India, what is the mandated target for domestic commercial banks to lend to the agriculture sector out of Adjusted Net Bank Credit (ANBC)?
(A) 10 percent
(B) 15 percent
(C) 18 percent
(D) 25 percent

10. The National Bank for Agriculture and Rural Development (NABARD) acts primarily as which of the following?
(A) A direct institutional credit body for individual small and marginal farmers
(B) An apex refinancing institution for agricultural and rural credit
(C) An apex regulatory authority for managing direct investments in agriculture
(D) A primary cooperative credit society operating at the village level

11. What has been the primary impact of the World Trade Organization (WTO) Agreement on Agriculture (AoA) on the Indian agricultural policy?
(A) India had to classify its agricultural subsidies into Amber, Blue, and Green Boxes.
(B) India was forced to completely phase out and abolish its Minimum Support Price system.
(C) India was required to impose total bans on selected agricultural imports from developed nations.
(D) India was mandated to permanently cease all public stockholding programs for food security.

12. Consider the following statements regarding the features of the Kisan Credit Card (KCC) scheme:
I. It provides short-term credit limits to farmers for crop production and post-harvest expenses.
II. Animal husbandry and fisheries farmers are not eligible for KCC.
III. The credit limit is fixed based on operational land holding, cropping pattern, and scale of finance.

Which of the above statements is/are correct?
(A) I and II
(B) II and III
(C) I and III
(D) I, II and III

13. The removal of Quantitative Restrictions (QRs) on agricultural imports by India in 2001 was a direct consequence of which policy?
(A) Implementation of the National Agriculture Policy 2000 framework
(B) Directives issued under the Atmanirbhar Bharat Abhiyan scheme
(C) Structural initiatives of the Green Revolution Phase II program
(D) WTO commitments and economic liberalization policies

14. In the context of the systematic agricultural planning process, what is the primary role of the District Planning Committee (DPC)?
(A) To unilaterally establish and enforce Minimum Support Prices for agricultural produce across the district
(B) To procure and distribute chemical fertilizers directly to small and marginal farmers in rural areas
(C) To consolidate Panchayat and Municipality plans into a draft district development plan
(D) To regulate and monitor the direct export of major agricultural commodities from local mandis to foreign countries

15. The 'Bottom-up' approach in agricultural plan formulation implies that:
(A) Agricultural planning is completely centralized and formulated exclusively at the national NITI Aayog level.
(B) Planning starts at the grass-root level with Gram Panchayats and moves upward to the state.
(C) Central financial allocations are made exclusively to the lowest performing agricultural districts nationwide.
(D) Policy plans are formulated by foreign multinational corporations and directly imposed on local farming communities.

16. During the preparation of a micro-level agricultural plan, which of the following stakeholders is primarily responsible for providing scientific and technical validation of crop plans at the district level?

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48. Given below are two statements, one labelled as Assertion (A) and the other as Reason (R):
Assertion (A): Legalizing agricultural land leasing is considered a necessary economic reform for rural development.
Reason (R): Formal lease agreements allow tenant farmers to access institutional credit, crop insurance, and agricultural subsidies seamlessly.
In the context of the above statements, select the correct answer from the options given below:
(A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
(B) Both Assertion (A) and Reason (R) are true but R is not the correct explanation of A.
(C) Assertion (A) is true but Reason (R) is false.
(D) Assertion (A) is false but Reason (R) is true.

49. How is the actual crop yield for assessing localized losses under the Pradhan Mantri Fasal Bima Yojana (PMFBY) primarily estimated?
(A) By conducting standard Crop Cutting Experiments (CCEs) in notified areas
(B) By collecting self-reported yield declarations and individual loss estimates directly from farmers
(C) Through exclusive reliance on high-resolution state-wide satellite remote sensing imagery analysis
(D) By determining historical average yield figures computed over the preceding fifty-year period

50. The Weather Based Crop Insurance Scheme (WBCIS) provides financial protection to farmers against adverse weather conditions. Unlike PMFBY, claim settlements under WBCIS are triggered based on:
(A) Individual physical assessments of crop damage conducted on every affected farm plot
(B) Verification of the net total volume of harvested produce sold by the farmer at local APMC mandis
(C) Deviations in weather parameters like rainfall and temperature from set thresholds
(D) Mandatory post-harvest visual inspections conducted by the local Patwari and revenue officials

51. National Innovations on Climate Resilient Agriculture (NICRA) is a flagship network project launched in 2011 by which organization?
(A) Indian Council of Agricultural Research (ICAR)
(B) NITI Aayog
(C) NABARD
(D) Ministry of Environment, Forest and Climate Change

52. The 'Rainfed Area Development' (RAD) component under the National Mission for Sustainable Agriculture (NMSA) emphasizes:
(A) Encouraging all farmers in rainfed regions to transition exclusively to water-intensive commercial cash crops
(B) Prioritizing the construction of massive multi-purpose river valley dams and major irrigation canal networks
(C) Offering unmetered free electricity supply to incentivize deep tube-well extraction for groundwater irrigation
(D) Promoting Integrated Farming Systems (IFS) to enhance productivity and mitigate climate risks

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53. In the context of climate-resilient agriculture practices for sugarcane cultivation, what is the primary benefit of 'Trash Mulching'?
(A) It completely and permanently prevents the occurrence and spread of red rot fungal disease in crop fields.
(B) It conserves soil moisture and suppresses weeds, reducing irrigation needs.
(C) It excessively stimulates vegetative canopy growth to an extent that reduces final sugar recovery rates.
(D) It fully substitutes for and replaces the entire requirement of synthetic nitrogenous fertilizers in soil.

54. The Agriculture Export Policy (AEP) 2018 aimed to achieve which of the following primary financial targets?
(A) Restrict agricultural exports to less than US$ 10 billion to ensure food security
(B) Completely abolish export duties on all items forever
(C) Double India's agricultural exports to US$ 60 billion
(D) Ensure 100% export of all sugarcane produced in Uttar Pradesh

55. Match List I with List II and select the correct answer using the options given below:
List I: (Climate-Resilient Practice)
P. Zero Tillage
Q. Drip Irrigation
R. Contour Bunding

25. Match List I with List II and select the correct answer using the options given below:
List I: (Term/Institution)
P. SFAC
Q. CACP
R. APEDA
S. NABARD
List II: (Key Function/Role)
1. Recommends Minimum Support Prices and FRP
2. Apex institution for rural credit and refinancing
3. Promotion of Farmer Producer Organisations (FPOs)
4. Promotion of agricultural and processed food exports
(A) P-1, Q-3, R-2, S-4
(B) P-3, Q-1, R-4, S-2
(C) P-3, Q-4, R-1, S-2
(D) P-2, Q-1, R-4, S-3

26. In the administrative structure of the Uttar Pradesh sugarcane sector, what is the primary role of Cane Cooperative Societies?
(A) To directly manufacture and market refined commercial sugar from raw harvested sugarcane
(B) To coordinate cane supply and payment distribution between farmers and sugar mills
(C) To manage and execute the export of surplus refined sugar directly to international markets
(D) To conduct advanced genetic and agronomic research on high-yielding sugarcane crop varieties

27. The principle of 'Comparative Advantage' in agricultural production planning suggests that a region should:
(A) Specialize in crops with lower relative opportunity cost and favorable agro-climatic conditions
(B) Produce all agricultural commodities locally to achieve complete regional food self-sufficiency regardless of input cost
(C) Focus resources exclusively on cultivating the highest-priced export cash crop available on global commodity markets
(D) Avoid cross-border and regional agricultural trade entirely to protect local farming sectors from external market volatility

28. Consider the following statements regarding Farmer Producer Organisations (FPOs):
I. They aim to enhance the bargaining power of small and marginal farmers.
II. FPOs cannot engage in value addition or processing of agricultural produce.
III. The Government of India launched a scheme to form and promote 10,000 new FPOs.
Which of the above statements is/are correct?
(A) I and II
(B) II and III
(C) I and III
(D) I, II and III

29. A farmer wants to calculate the expected financial impact of replacing an existing sugarcane variety with a newly recommended high-yielding variety, without changing the rest of the farm operations. Which farm planning tool should the farmer use?
(A) Complete Budgeting
(B) Enterprise Budgeting
(C) Cash Flow Budgeting
(D) Partial Budgeting

30. The Law of Diminishing Marginal Returns in agriculture indicates that as successive units of a variable input (e.g., fertilizer) are added to a fixed input (e.g., land):
(A) Total physical output will continue to increase indefinitely and at an increasing rate.
(B) Total farm output will abruptly drop and eventually decline to zero in the current season.
(C) The additional output gained per extra unit of input will eventually decrease.
(D) The marginal physical product of the variable input remains permanently constant at all levels.

31. Crop diversification is considered a crucial policy tool for risk management in agriculture. In Uttar Pradesh, which of the following is a standard recommended intercropping practice to diversify sugarcane farming?
(A) Spring Sugarcane + Rainfed Monsoon Paddy
(B) Autumn Sugarcane + Potato / Mustard
(C) Summer Sugarcane + Kharif Pearl Millet
(D) Late Sugarcane + Commercial Fiber Jute

32. Consider the following steps involved in the farm planning process:
I. Execution of the selected farm plan
II. Identification of available farm resources and constraints
III. Formulation of alternative farm plans

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(A) Primary Agricultural Credit Societies (PACS)
(B) Revenue Inspectors
(C) Food Corporation of India (FCI)
(D) Krishi Vigyan Kendras (KVKs)

17. In which of the following Five-Year Plans did the agriculture sector receive the highest proportional allocation of the total plan outlay?
(A) First Five-Year Plan
(B) Second Five-Year Plan
(C) Seventh Five-Year Plan
(D) Tenth Five-Year Plan

18. Given below are two statements, one labelled as Assertion (A) and the other as Reason (R):
Assertion (A): Participatory Rural Appraisal (PRA) is extensively used in modern micro-level agricultural planning.
Reason (R): PRA enables local farmers to analyze their own resources and farming conditions, thereby ensuring their active participation in the planning process.
In the context of the above statements, select the correct answer from the options given below:
(A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
(B) Both Assertion (A) and Reason (R) are true but R is not the correct explanation of A.
(C) Assertion (A) is true but Reason (R) is false.
(D) Assertion (A) is false but Reason (R) is true.

19. The strategy of the Green Revolution, focused on HYV seeds, fertilizers, and irrigation, was adopted by the Government of India during which planning period?
(A) Second Five-Year Plan
(B) Third Five-Year Plan
(C) Annual Plans (1966-1969)
(D) Fifth Five-Year Plan

20. Which major agricultural scheme was launched during the 11th Five-Year Plan to incentivize states to increase public investment in agriculture and allied sectors?
(A) Pradhan Mantri Krishi Sinchayee Yojana (PMKSY)
(B) National Agriculture Market (e-NAM)
(C) Pradhan Mantri Fasal Bima Yojana (PMFBY)
(D) Rashtriya Krishi Vikas Yojana (RKVY)

21. NITI Aayog's primary role in formulating major agricultural policies involves:
(A) Acting as a direct regulatory and funding agency for all state agricultural universities nationwide
(B) Serving as a policy think-tank to foster cooperative federalism with states
(C) Directly managing the day-to-day procurement and storage operations of the Food Corporation of India
(D) Setting and enforcing the Fair and Remunerative Price for sugarcane independently of central ministries

22. Consider the following major agricultural development programmes in India:
I. Intensive Agricultural District Programme (IADP)
II. High Yielding Varieties Programme (HYVP)
III. National Mission on Sustainable Agriculture (NMSA)
IV. National Agricultural Technology Project (NATP)
Which of the following represents the correct chronological order of their launch?
(A) I, II, IV, III
(B) II, I, IV, III
(C) I, IV, II, III
(D) IV, I, II, III

23. What is the central goal of the Agricultural Marketing and Farmer Friendly Reforms Index (AMFFRI) introduced by NITI Aayog?
(A) To evaluate and measure the total annual volume and financial value of agricultural exports from each state
(B) To assess and monitor the overall nutritional quality and safety standards of agricultural produce in mandis
(C) To calculate and audit the net institutional credit disbursed directly to small farmers across different states
(D) To rank states on agricultural marketing reforms and ease of doing agri-business

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24. A Farmer Producer Organisation (FPO) under the government's recent scheme is primarily registered under which legal frameworks?
(A) Companies Act or Cooperative Societies Act
(B) Societies Registration Act under the relevant state jurisdiction
(C) Indian Partnership Act governing commercial partnership firms
(D) Trade Unions Act regulating labor union organizations

2. Umbrella scheme for ensuring remunerative prices for crops
3. Pan-India electronic trading portal for farm produce
4. Yield-index based comprehensive crop insurance

(A) P-3, Q-1, R-2, S-4
(B) P-1, Q-3, R-2, S-4
(C) P-3, Q-2, R-1, S-4
(D) P-2, Q-1, R-4, S-3

41. What is the primary objective of the National Agriculture Market (e-NAM) platform?
(A) To physically collect and transport all harvested commodities to a single government warehouse in New Delhi
(B) To create a unified national market by networking existing APMC mandis
(C) To bypass individual farmers entirely by restricting commodity trading exclusively to large corporate entities
(D) To establish statutory government regulations over the private purchase and transfer of rural agricultural land

42. In order for a State to integrate its agricultural mandis with the e-NAM platform, it must implement which of the following prerequisites in its APMC Act?
(A) Provision for e-auction/electronic trading
(B) Implementation of a single point levy of market fee
(C) Provision for a single unified trading license valid across the state
(D) All of the above

43. Disintermediation in agricultural marketing policy refers to:
(A) Eliminating intermediary layers between farmers and final consumers or processors
(B) Systematically expanding the number of licensed middlemen to accelerate the physical transport of harvested produce
(C) Imposing complete statutory bans on the operation of digital trading platforms and electronic auctions in rural areas
(D) Enforcing strict legal regulations that prohibit individual farmers from marketing goods outside village boundaries

44. As part of India's Digital Agriculture Policy, the concept of 'AgriStack' is primarily being developed to create:
(A) A centralized national registry tracking all farm tractors, machinery, and mechanized implements across states
(B) A dedicated government e-commerce portal authorized exclusively for selling subsidized chemical fertilizers
(C) A federated farmer database linked to land records providing unique digital IDs
(D) A specialized online professional network created exclusively for agricultural scientists and extension officials

45. Consider the following statements regarding digital agriculture initiatives in India:
I. The Kisan Suvidha App provides information on weather, input dealers, and market prices.
II. The 'Kisan Drone' scheme promotes the use of drones for crop assessment and spraying of nutrients and pesticides.
III. Digital agriculture policies aim to completely replace physical extension workers with robots in the next two years.

Which of the above statements is/are correct?
(A) I and II
(B) II and III
(C) I and III
(D) I, II and III

46. The Model Agricultural Land Leasing Act, 2016, proposed by a NITI Aayog committee, primarily aimed to:
(A) Impose a comprehensive statutory ban on all forms of agricultural land leasing transactions across all states
(B) Forcefully expropriate and transfer land ownership rights from landlords to tenant farmers without compensation
(C) Legalize land leasing to protect owners while granting tenants access to credit and insurance
(D) Establish a mandatory uniform lease rent ceiling applicable to all categories of farmland nationwide

47. Under the Pradhan Mantri Fasal Bima Yojana (PMFBY), what is the maximum premium percentage payable by farmers for annual commercial and horticultural crops, such as sugarcane?
(A) 1.5%
(B) 2.0%
(C) 5.0%
(D) 10.0%

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CHAPTER 23

Agricultural Economic Reforms and Policy Planning

1. What is the primary objective of implementing agricultural economic reforms in India?
(A) To integrate the agriculture sector with domestic and global markets for better price realization
(B) To increase government control over individual crop production choices
(C) To strictly limit the export of agricultural commodities to ensure local food security only
(D) To eliminate the use of modern agricultural machinery to increase manual employment

2. Which of the following best describes the main focus of the second generation of economic reforms in the Indian agriculture sector?
(A) Implementation of the Zamindari Abolition Act
(B) Introduction of High Yielding Variety (HYV) seeds
(C) Institutional and market reforms such as APMC deregulation and contract farming
(D) Nationalization of commercial banks to provide agricultural credit

3. The Essential Commodities Act, 1955 was amended in recent years primarily to achieve which of the following objectives for the agriculture sector?
(A) To remove arbitrary stock limits and attract private investment in agricultural supply chains
(B) To completely ban the export of all essential food grains
(C) To make the hoarding of all agricultural produce a non-bailable offense for farmers
(D) To fix the maximum retail price for all fruits and vegetables across India

4. Under the Uttar Pradesh Zamindari Abolition and Land Reforms Act, 1950, which category of tenure holders was granted permanent, heritable, and transferable rights to their land?
(A) Asami
(B) Sirdar
(C) Adhivasi
(D) Bhumidhar

5. What is the primary socio-economic objective of imposing a ceiling on agricultural land holdings?
(A) To increase the average size of operational holdings for mechanized farming
(B) To reduce income and wealth disparities by distributing surplus land to the landless
(C) To encourage corporate farming by large private enterprises
(D) To maximize the collection of land revenue from small farmers

6. Which of the following was a major negative socio-economic consequence of poorly implemented land reforms in some regions?
(A) Unprecedented consolidation of land holdings
(B) Complete elimination of small and marginal farmers
(C) Emergence of concealed tenancy and eviction of sharecroppers
(D) Excessive rise in institutional credit flow to tenant farmers

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The Kisan Credit Card (KCC) scheme was introduced in 1998 on the recommendation of which committee?
(A) Shivaraman Committee
(B) Narasimham Committee
(C) Rangarajan Committee
(D) R.V. Gupta Committee

8. Consider the following statements regarding the Uttar Pradesh land revenue systems and reforms:
I. The Zamindari Abolition Act aimed to establish a direct relationship between the state and the tiller.
II. Consolidation of holdings (Chakbandi) prevents fragmentation of agricultural land.
III. Under current UP revenue laws, a farmer can accumulate unlimited agricultural land without any ceiling.

S. Seed Treatment

List II: (Primary Purpose/Benefit)

1. Maximizes water use efficiency
2. Reduces soil erosion on sloping lands
3. Minimizes soil disturbance and retains moisture
4. Protects setts against soil-borne diseases

(A) P-1, Q-3, R-2, S-4
(B) P-3, Q-2, R-1, S-4
(C) P-2, Q-1, R-4, S-3
(D) P-3, Q-1, R-2, S-4

56. Under the Atmanirbhar Bharat Abhiyan framework, the 'PM Formalisation of Micro Food Processing Enterprises (PM-FME)' scheme is designed primarily on which approach?
(A) One District, One Product
(B) One Nation, One Agricultural Market
(C) Per Drop More Crop Irrigation Initiative
(D) Lab to Land Technological Transfer Model

57. Which government initiative under the Atmanirbhar Bharat package was announced specifically to create processing and value addition infrastructure for dairy, meat, and animal feed plants?
(A) Agriculture Infrastructure Fund for post-harvest management
(B) Animal Husbandry Infrastructure Development Fund
(C) Rashtriya Gokul Mission for indigenous breed development
(D) National Livestock Mission for sustainable equine and small ruminant development

58. Consider the following strategies regarding India's Agriculture Export Policy 2018:
I. Providing institutional mechanisms for market access and overcoming sanitary and phytosanitary barriers.
II. Developing agriculture export clusters for specific crops in specific regions.
III. Banning the participation of private players in agricultural export chains.
Which of the above statements is/are correct?
(A) I and II
(B) II and III
(C) I and III
(D) I, II and III

59. As part of agricultural market reforms, the 'Operation Greens' scheme was originally launched for which of the following crops, before being extended to all fruits and vegetables?
(A) Tomato, Onion, and Potato
(B) Wheat, Rice, and Yellow Maize
(C) Sugarcane, Raw Cotton, and Jute
(D) Apple, Fresh Banana, and Mango

60. Consider the following statements regarding the recommendations of the Dalwai Committee on Doubling Farmers' Income:
I. It advocated a shift in focus from merely increasing agricultural production to increasing farmers' net income.
II. It recommended heavy reliance solely on increasing the Minimum Support Price (MSP) to achieve the target.
III. It emphasized improving resource use efficiency to reduce the cost of cultivation.
Which of the above statements is/are correct?
(A) I and II
(B) II and III
(C) I and III
(D) I, II and III

61. Increasing the 'Cropping Intensity' is a major strategy for maximizing farm income. What does cropping intensity precisely measure?
(A) The cumulative quantity of synthetic fertilizers applied per unit of gross cropped area
(B) The total average number of full-time agricultural laborers employed per hectare of operational land
(C) The net total volume of irrigation water consumed across all crop fields during a farming season
(D) Gross cropped area divided by net sown area, multiplied by 100

62. Consider the following key agricultural institutions in India:
I. National Bank for Agriculture and Rural Development (NABARD)
II. Food Corporation of India (FCI)
III. NITI Aayog
IV. Agricultural and Processed Food Products Export Development Authority (APEDA)
Which of the following represents the correct chronological order of their establishment?
(A) II, I, IV, III
(B) I, II, III, IV
(C) II, IV, I, III
(D) I, IV, II, III

63. The Public-Private Partnership for Integrated Agricultural Development (PPP-IAD) model is

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IV. Selection of the most profitable farm plan
Which of the following represents the correct logical sequence of these steps?
(A) II, III, IV, I
(B) III, II, I, IV
(C) II, IV, III, I
(D) IV, III, II, I

33. Shifting from a purely mono-cropping system (like continuous Rice-Wheat) to a diversified cropping system primarily helps the farmer by:
(A) Reducing both yield risk and price volatility
(B) Significantly increasing overall farm reliance on expensive chemical fertilizers
(C) Substantially lowering the cumulative nutritional value of total harvested produce
(D) Making the immediate acquisition and deployment of heavy farm machinery mandatory

34. To attract private investment in post-harvest agricultural infrastructure, the Government of India launched the Agriculture Infrastructure Fund (AIF). What is the interest subvention provided under this scheme?
(A) 1% per annum
(B) 3% per annum
(C) 5% per annum
(D) 7% per annum

35. Consider the following statements regarding the benefits of crop diversification in an agricultural policy context:
I. It improves soil health and breaks pest cycles.
II. It increases vulnerability to extreme climate variations.
III. It stabilizes farm income by providing multiple revenue streams.
IV. It enhances nutritional security by expanding the variety of food produced.
Which of the above statements are correct?
(A) I, II and III
(B) I, III and IV
(C) II, III and IV
(D) I, II, III and IV

36. Under the current Foreign Direct Investment (FDI) policy of India, what is the maximum permissible limit of FDI in agricultural activities such as floriculture, horticulture, and seed development under the automatic route?
(A) 26%
(B) 49%
(C) 74%
(D) 100%

37. The Model Contract Farming Act, 2018, formulated by the Government of India, has a key provision that states:
(A) Contract farming operations and transactions are strictly retained under the statutory oversight of State APMC Acts.
(B) It removes contract farming from APMC jurisdiction, enabling direct purchase from farmers.
(C) Purchasing companies are legally authorized to permanently take ownership of the contracted farmer's land.
(D) It establishes a strict legal framework making participation in contract farming mandatory for all smallholders.

38. The inherently organized nature of the sugarcane industry in Uttar Pradesh acts similarly to contract farming because:
(A) Sugarcane growers are legally compelled to export their harvested produce exclusively to international trading entities.
(B) Processing mills are legally granted authority to forcibly lease land holdings from local farmers for direct cultivation.
(C) Statutory reservation of cane areas obligates farmers to supply designated mills at set prices.
(D) The entire annual harvested crop across all regions is directly procured by central agencies like the Food Corporation of India.

39. Which institutional model of contract farming involves a processor directly providing inputs, technical assistance, and purchasing the crop from a large number of contracted farmers?
(A) Multipartite Model
(B) Intermediary Model
(C) Informal Model
(D) Centralized Model

40. Match List I with List II and select the correct answer using the options given below:
List I: (Reform Initiative)
P. e-NAM
Q. AIF
R. PM-AASHA
S. PMFBY
List II: (Core Feature)
1. Interest subvention for post-harvest infrastructure

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(C) General Manager of the respective sugar mill
(D) Sugarcane Commissioner

72. Match List I with List II and select the correct answer using the options given below:
List I: (Sugarcane Parameter/Concept)
P. FRP
Q. SAP
R. Recovery Percentage
S. Parchi
List II: (Description)
1. Proportion of sugar extracted from the cane crushed
2. Price declared by the State Government for sugarcane
3. Minimum price fixed by the Central Government linked to basic recovery
4. The cane supply slip/indent issued to the farmer
(A) P-3, Q-2, R-1, S-4
(B) P-2, Q-3, R-1, S-4
(C) P-3, Q-1, R-2, S-4
(D) P-1, Q-2, R-3, S-4

73. The Uttar Pradesh Government launched the 'E-Ganna App' and web portal primarily to ensure:
(A) Facilitating the direct benefit transfer of high-yielding seed subsidies to small wheat farmers
(B) Ensuring transparency in cane supply slips (Parchi) and supply calendar management
(C) Enabling the direct online sale and retail distribution of refined sugar to domestic consumers
(D) Managing real-time satellite tracking and deployment of automated sugarcane harvesting machinery

74. Historically, where was the first modern sugar mill of India established in 1903?
(A) Meerut District, Uttar Pradesh
(B) Pratappur, Uttar Pradesh
(C) Pune District, Maharashtra
(D) Coimbatore, State of Tamil Nadu

75. Consider the following statements regarding the UP Sugarcane (Regulation of Supply and Purchase) Act, 1953:
I. It regulates the supply and purchase of sugarcane required for use in sugar factories and gur/khandsari units.
II. It facilitates the constitution of Cane Development Councils.
III. It permits any sugar mill to procure sugarcane from outside the state without any permission from the Cane Commissioner.
Which of the above statements is/are correct?
(A) I and II
(B) II and III
(C) I and III
(D) I, II and III

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76. To promote ethanol blending and improve the financial viability of sugar mills, the Uttar Pradesh Government implemented a policy focusing on which specific industrial integration?
(A) Sugar Industry and Textile Integration Policy
(B) Sugarcane-Plastics Industrial Diversification Policy
(C) Sugar Cogeneration and Distillery Policy
(D) Sugarcane-Steel Allied Manufacturing Alliance Policy

77. According to standard sugarcane regulations applicable in Uttar Pradesh, what is the mandated minimum radial distance between an existing sugar mill and a proposed new sugar mill?
(A) 5 km
(B) 10 km
(C) 15 km
(D) 25 km

78. Under the Uttar Pradesh Mukhya Mantri Krishak Durghatna Kalyan Yojana, what is the maximum financial assistance provided to the family of a farmer in case of accidental death or complete disability?
(A) Rs. 1 Lakh
(B) Rs. 2 Lakh
(C) Rs. 5 Lakh
(D) Rs. 10 Lakh

79. Given below are two statements, one labelled as Assertion (A) and the other as Reason (R):
Assertion (A): Over the last decade, Uttar Pradesh has frequently surpassed Maharashtra to become the largest sugar-producing state in India, accompanied by a significant rise in its average sugar recovery rate.
Reason (R): The widespread adoption of the early-maturing, high-sugar yielding sugarcane variety Co-0238 revolutionized sugarcane production and sugar recovery in Uttar Pradesh.
In the context of the above statements, select the correct answer from the options given below:

aggregate smallholders for economies of scale. Under central government promotion schemes, an FPO is legally incorporated either as a Producer Company under the Companies Act (specifically Section 465A of the Companies Act, 2013 / Section 581 of 1956) or registered as a primary cooperative enterprise under relevant State Cooperative Societies Acts.

25. (B) P-3, Q-1, R-4, S-2
Small Farmers' Agribusiness Consortium is responsible for promoting and organizing Farmer Producer Organisations. The Commission for Agricultural Costs and Prices formulates pricing policy and recommends Minimum Support Prices along with the sugarcane FRP. The Agricultural and Processed Food Products Export Development Authority drives agricultural exports, while NABARD acts as the apex rural credit refinancing body.

26. (B) To coordinate cane supply and payment distribution between farmers and sugar mills
In Uttar Pradesh's institutional sugarcane sector, Cane Cooperative Societies serve as crucial legal intermediaries between member farmers and processing sugar mills. These societies manage sugarcane supply calendars, issue purchasing indents (Parchi) to growers, systematically monitor factory deliveries, and facilitate the timely disbursement of sugarcane price payments directly into registered bank accounts.

27. (A) Specialize in crops with lower relative opportunity cost and favorable agro-climatic conditions
The economic principle of Comparative Advantage in agricultural planning dictates that a region should allocate its resource base toward producing commodities for which it incurs a lower relative opportunity cost. By focusing production on crops best suited to local agro-climatic conditions and resource availability, regional agricultural efficiency is optimized, generating substantive long-term trade gains.

28. (C) I and III
Farmer Producer Organisations aggregate small and marginal landholders to enhance their collective bargaining power, lower input procurement costs, and facilitate market access. The Government of India introduced a dedicated central sector scheme to form and promote 10,000 new FPOs nationwide. Furthermore, FPOs are actively encouraged to engage in value addition, sorting, grading, and post-harvest crop processing.

29. (D) Partial Budgeting
Partial budgeting is an agricultural management tool used to evaluate the economic profitability of small, minor adjustments in farm operations without altering the entire farm plan. When assessing minor modifications, such as introducing a new high-yielding sugarcane variety in place of an older variety, partial budgeting calculates added costs, reduced revenues, and cost savings to determine net income.

30. (C) The additional output gained per extra unit of input will eventually decrease.
The Law of Diminishing Marginal Returns states that when successive increments of a variable factor, such as fertilizer, are applied to a fixed production factor, such as land area, total output initially increases, but the additional physical output produced per extra unit of input will eventually begin to decrease overall.

31. (B) Autumn Sugarcane + Potato / Mustard
In Uttar Pradesh, autumn sugarcane planting allows for intercropping with short-duration Rabi crops like potato, mustard, garlic, or wheat. Because autumn-sown sugarcane grows slowly during winter months, wide space between cane rows provides an ideal niche for intercrops without causing severe light or nutrient competition. This intercropping system optimizes land resource efficiency, enhances cropping intensity, and yields supplementary seasonal farm income.

32. (A) II, III, IV, I
The logical sequence of the farm planning process begins with inventorying available land, labor, and capital resources along with operational constraints. Next, the farmer formulates alternative crop and enterprise plans. After analyzing net returns, the most profitable plan is chosen. Finally, the selected plan is systematically executed in the field.

33. (A) Reducing both yield risk and price volatility
Transitioning from continuous mono-cropping to a diversified cropping system spreads agricultural risk across multiple enterprises with varying crop cycles, climate tolerances, and market demands. Diversification mitigates total yield loss risks

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ANSWERS

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1. (A) To integrate the agriculture sector with domestic and global markets for better price realization
Agricultural economic reforms in India focus on modernizing market structures, reducing supply chain friction, and removing restrictive trade barriers. Integrating the farming sector with national and international markets enables efficient price discovery and enhances farmers' income. By facilitating direct trade and private investment, these reforms aim to foster competitive pricing, mitigate market volatility, and expand commercial opportunities for agricultural producers across various regional markets.

2. (C) Institutional and market reforms such as APMC deregulation and contract farming
While the first generation of agricultural reforms focused primarily on land reforms and production technologies like the Green Revolution, the second generation emphasizes structural, institutional, and post-harvest market reforms. Key initiatives include deregulating the Agricultural Produce Market Committee mandis, encouraging contract farming, and promoting private sector investment. These measures seek to create a streamlined, efficient, and transparent agricultural marketing infrastructure.

3. (A) To remove arbitrary stock limits and attract private investment in agricultural supply chains
The Essential Commodities Act of 1955 was amended to eliminate frequent and unpredictable imposition of stock holding limits on agricultural commodities. This legislative reform aimed to encourage private sector participation, improve supply chain efficiency, and stimulate direct investment in cold storage, warehousing, and post-harvest infrastructure. Removing regulatory uncertainty helps stabilize agricultural prices and ensures better market opportunities for farming communities across the country.

4. (D) Bhumidhar
The Uttar Pradesh Zamindari Abolition and Land Reforms Act of 1950 restructured land tenure systems into distinct legal categories. Among these, the Bhumidhar represented the highest class of tenure holder, endowed with permanent, heritable, and transferable land rights. Unlike other tenure classes such as Sirdar or Asami, Bhumidhars possessed complete authority to sell, mortgage, or transfer their land subject to regulatory ceilings.

5. (B) To reduce income and wealth disparities by distributing surplus land to the landless
Imposing ceiling limits on agricultural land holdings is a core land reform measure aimed at promoting social equity and redistributive justice in rural areas. By establishing a maximum limit on individual or family landownership, state governments declare excess land as surplus. This surplus land is subsequently acquired and redistributed among landless agricultural laborers, marginal farmers, and marginalized socio-economic communities to reduce wealth disparities.

6. (C) Emergence of concealed tenancy and eviction of sharecroppers
Flaws in tenancy laws and poor administrative enforcement led landowners to legally evict sharecroppers and tenant farmers to prevent them from claiming permanent land rights. To bypass tenancy ceiling and protection regulations, landowners resorted to informal, unrecorded, or concealed tenancy arrangements. Consequently, vulnerable tenant farmers were deprived of tenure security, credit access, and institutional support while remaining exposed to exploitation and sudden unlawful evictions.

7. (D) R.V. Gupta Committee
The Kisan Credit Card scheme was formulated in 1998 following the recommendations of the High Level Committee on Agricultural Credit, headed by R.V. Gupta. NABARD designed the scheme to deliver timely, flexible, and simplified credit to farmers across India. It replaced cumbersome traditional procedure requirements with a single revolving credit limit, facilitating smooth access to short-term agricultural operational loans from commercial and cooperative institutions.

62. (A) II, I, IV, III
The chronological order of these key Indian agricultural institutions begins with the establishment of the Food Corporation of India in 1965. The National Bank for Agriculture and Rural Development was subsequently founded in 1982. APEDA was formed in 1986, while NITI Aayog was officially established in 2015 replacing the commission.

63. (B) Rashtriya Krishi Vikas Yojana (RKVY)
The Public-Private Partnership for Integrated Agricultural Development model was launched as an operational scheme under the Rashtriya Krishi Vikas Yojana framework. PPP-IAD provides a structured platform allowing private corporate agribusinesses to collaborate with state governments to execute integrated agricultural value chain projects and infrastructure developments across farming districts state-wide today.

64. (D) A capital grant by the government to make essential projects commercially viable
In public-private partnership infrastructure projects, Viability Gap Funding represents a financial grant provided by the government to bridge economic shortfalls in capital-intensive development projects. VGF is specifically deployed for projects—such as modern bulk grain silos and rural market logistics—that are economically necessary but commercially unviable without direct public capital subsidies.

65. (A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
The Agri-Clinics and Agri-Business Centres scheme exemplifies successful public-private partnership in agricultural extension. Managed by MANAGE and funded via NABARD, the scheme trains unemployed agricultural graduates to establish private commercial ventures that provide technical advice, crop protection, and inputs on a fee-for-service basis, effectively supplementing public extension system delivery networks.

66. (C) Commission for Agricultural Costs and Prices (CACP)
The Fair and Remunerative Price is the statutory minimum price that sugar mills are legally obligated to pay to sugarcane farmers. The FRP is fixed annually by the Central Government based on statutory recommendations submitted by the Commission for Agricultural Costs and Prices after evaluating production costs and recovery benchmarks.

67. (A) The Essential Commodities Act, 1955
The Sugarcane (Control) Order, 1966, which provides the overarching statutory authority for fixing the Fair and Remunerative Price of sugarcane, regulating cane distribution, and enforcing factory purchase zones, was promulgated by the Central Government under Section 3 of the Essential Commodities Act, 1955 to protect cane growers and ensure supply.

68. (D) Higher than the centrally declared FRP
State Advised Price is an elevated sugarcane price announced annually by select key sugar-producing state governments, including Uttar Pradesh, Uttarakhand, and Punjab. The SAP is typically determined at a rate substantially higher than the central government's Fair and Remunerative Price to account for higher local operational production expenses incurred regionally.

69. (D) I, II, III and IV
Under Clause 3(1) of the Sugarcane (Control) Order, 1966, the CACP evaluates comprehensive statutory factors when recommending the FRP. These factors include the cost of production of sugarcane, returns from alternative crops, general price trends, sugar recovery percentage, sale prices of sugar, and realizations from processed cane by-products sold commercially.

70. (C) Rangarajan Committee
In 2012, the High-Level Expert Committee headed by Dr. C. Rangarajan recommended a comprehensive Revenue Sharing Formula for the sugarcane sector. The committee suggested that sugarcane growers receive 70 percent of total revenue generated by sugar mills from sugar sales, or 75 percent including primary by-products like molasses and power.

71. (D) Sugarcane Commissioner
Under Section 15 of the Uttar Pradesh Sugarcane (Regulation of Supply and Purchase) Act, 1953, the statutory authority to declare, modify, and delineate reserved or assigned areas for a sugar mill rests exclusively with the Sugarcane Commissioner. The Commissioner issues official reservation orders regulating cane supply boundaries before crushing seasons.

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16. (D) Krishi Vigyan Kendras (KVKs)
Krishi Vigyan Kendras serve as frontline agricultural extension assessment centers established by the Indian Council of Agricultural Research at the district level. During micro-level agricultural planning, these centers provide essential scientific validation, technological guidance, location-specific crop suitability assessments, and adaptive trial evaluations. Their technical expertise ensures that district crop plans incorporate modern agronomic practices, appropriate varieties, and sustainable pest management strategies.

17. (A) First Five-Year Plan
The First Five-Year Plan prioritized agricultural development to resolve severe national food shortages following independence and partition. Approximately 31 percent of the total public sector plan outlay was allocated directly to agriculture, community development, and major irrigation projects. This represents the highest proportional resource allocation dedicated to the agriculture and allied sector across all post-independence Five-Year Planning cycles in India.

18. (A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
Participatory Rural Appraisal is a structured qualitative research methodology widely utilized in micro-level agricultural planning. It empowers rural communities to analyze their living conditions, map local natural resources, identify farming constraints, and formulate targeted local interventions. Because the core function of the methodology is active stakeholder participation in self-assessment, the provided explanation accurately justifies the extensive reliance on participatory rural appraisals in planning.

19. (C) Annual Plans (1966-1969)
Following severe droughts and food crises in the mid-1960s, the Government of India formally launched the High Yielding Varieties Programme, marking the technological onset of the Green Revolution. This intensive strategy—integrating HYV seeds, chemical fertilizers, expanded credit, and controlled irrigation—was adopted and implemented during the three Annual Plans spanning from 1966 to 1969, immediately preceding the Fourth Five-Year Plan.

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20. (D) Rashtriya Krishi Vikas Yojana (RKVY)
Launched in 2007 during the 11th Five-Year Plan, Rashtriya Krishi Vikas Yojana was introduced as an umbrella scheme to incentivize state governments to increase public funding in agriculture and allied sectors. The scheme granted financial flexibility and autonomy to states to plan and execute location-specific agricultural development strategies based on comprehensive district agricultural plans, ultimately driving higher sector growth rates.

21. (B) Serving as a policy think-tank to foster cooperative federalism with states
NITI Aayog functions primarily as the premier policy think-tank of the Government of India, structured to foster cooperative federalism by engaging state governments in long-term strategic policy formulation. In the agricultural sector, it offers strategic policy recommendations, designs model legislation, conducts outcome evaluations, and facilitates dialogue between central ministries and states rather than acting as a direct operational funding or regulatory body.

22. (A) I, II, IV, III
The chronological timeline of these agricultural initiatives begins with the Intensive Agricultural District Programme, launched in 1960. The High Yielding Varieties Programme was subsequently established in 1966. The National Agricultural Technology Project was implemented in 1998 to strengthen agricultural research and extension. Finally, the National Mission on Sustainable Agriculture was launched in 2014 under the National Action Plan on Climate Change.

23. (D) To rank states on agricultural marketing reforms and ease of doing agri-business
The Agricultural Marketing and Farmer Friendly Reforms Index was launched by NITI Aayog to evaluate and rank Indian states based on their progress in implementing structural marketing reforms. The index monitors key areas including APMC deregulation, single trading licenses, electronic trading adoption, land leasing framework, and contract farming regulations, thereby encouraging competitive federalism across all Indian states.

24. (A) Companies Act or Cooperative Societies Act
Farmer Producer Organisations are producer-owned legal entities institutionalized to

(A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
(B) Both Assertion (A) and Reason (R) are true but R is not the correct explanation of A.
(C) Assertion (A) is true but Reason (R) is false.
(D) Assertion (A) is false but Reason (R) is true.

80. The broad target for the annual agricultural growth rate envisaged in the State Agriculture Policy 2013 of Uttar Pradesh was:
(A) 2.5%
(B) 4.0%
(C) 5.1%
(D) 8.5%

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arising from extreme weather or pest outbreaks, while simultaneously cushioning farmers against price volatility associated with single harvested commodity sales.

34. (B) 3% per annum
The Agriculture Infrastructure Fund is a financing facility created to mobilize capital investment in post-harvest infrastructure and community farming assets. Under this scheme, all loans disbursed up to a limit of Rs. 2 crore carry an interest subvention of 3% per annum for a maximum duration of seven calendar years.

35. (B) I, III and IV
Crop diversification provides multiple agronomic and socio-economic benefits. Introducing varied crops enhances soil fertility and disrupts host-pest cycles. Producing a diverse array of agricultural commodities offers multiple revenue streams that stabilize overall household farm income, while expanding food variety to improve nutritional security across rural farming regions and local markets.

36. (D) 100%
Under the extant Foreign Direct Investment policy of India, 100% foreign direct investment is permitted under the automatic route in specified agricultural activities. These eligible activities include floriculture, horticulture, apiculture, mushroom cultivation, animal husbandry, and seed development, aimed at promoting modern technology, foreign capital, and infrastructure expansion in Indian agriculture.

37. (B) It removes contract farming from APMC jurisdiction, enabling direct purchase from farmers.
The Model Contract Farming Act of 2018 was formulated to establish an institutional mechanism for buyer-producer agreements. A key feature of the act is removing contract farming transactions from the regulatory purview of state APMC Acts. This exempts contracting buyers from paying market fees on direct farm gate purchases from local growers.

38. (C) Statutory reservation of cane areas obligates farmers to supply designated mills at set prices.
The organized sugarcane sector in Uttar Pradesh functions similarly to formal contract farming due to statutory regulatory zoning under sugarcane supply acts. The State Sugarcane Commissioner legally demarcates a designated 'Reserved Area' for every sugar mill. This arrangement obligates local growers within the zone to supply their cane at prices.

39. (D) Centralized Model
Under the Centralized Model of contract farming, a centralized agribusiness processor or buying company enters into formal contractual arrangements with a large number of smallholder farmers. The company provides physical production inputs, technical extension guidance, and purchasing guarantees for harvested produce meeting specified pre-agreed crop quality standards and pricing agreements.

40. (A) P-3, Q-1, R-2, S-4
The National Agriculture Market serves as a pan-India electronic trading portal connecting wholesale mandis. The Agriculture Infrastructure Fund provides interest subvention for post-harvest infrastructure investments. PM-AASHA is an umbrella pricing scheme designed to protect farmer returns, and PMFBY offers yield-index based comprehensive crop insurance against natural seasonal yield risk events.

41. (B) To create a unified national market by networking existing APMC mandis
The primary objective of the National Agriculture Market portal is to integrate existing regulated APMC mandis across India into a single online trading platform. By enabling transparent online bidding, real-time price discovery, and digital payments, e-NAM mitigates geographical market fragmentation and guarantees enhanced price realization for producers across the country.

42. (D) All of the above
To qualify for integration and technical onboarding with the e-NAM electronic trading platform, state governments must mandate three essential legislative prerequisites in their respective APMC Acts: introducing formal legal provisions for electronic auctions, granting a single unified state-wide trading license, and enacting a single-point market fee structure across all mandis.

43. (A) Eliminating intermediary layers between farmers and final consumers or processors
Disintermediation in agricultural marketing policy refers to the strategic policy goal of bypassing redundant intermediary layers and

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brokers in supply chains. By establishing direct transaction channels between farmers and processors, retailers, or consumers, disintermediation reduces marketing transaction costs, minimizes post-harvest losses, and maximizes net price returns for primary farming producers.

44. (C) A federated farmer database linked to land records providing unique digital IDs
Under Digital Agriculture Policy, AgriStack is being developed as a national federated digital ecosystem that assigns unique digital IDs to farmers. By linking farmer identities directly to digital land ownership records, crop registries, and spatial data, AgriStack enables targeted delivery of agricultural subsidies, tailored advice, and seamless formal credit assistance.

45. (A) I and II
Digital agriculture initiatives deploy modern technology to empower rural farmers. The Kisan Suvidha mobile app offers critical agricultural updates regarding local weather forecasts, input dealers, commodity market prices, and advisories. Similarly, the Kisan Drone scheme incentivizes drone usage for precise crop assessment, land mapping, and targeted chemical spraying operations field-wide.

46. (C) Legalize land leasing to protect owners while granting tenants access to credit and insurance
The Model Agricultural Land Leasing Act of 2016, designed by NITI Aayog, aimed to institutionalize and legalize land leasing across states. The act ensures that land ownership rights remain protected without risk of illegal tenant encroachment, while simultaneously granting tenant farmers access to institutional credit, crop insurance, and financial support.

47. (C) 5.0%
Under the Pradhan Mantri Fasal Bima Yojana, premium rates payable by farmers are heavily subsidized to promote financial affordability. While the actuarial premium for Kharif crops is 2.0% and Rabi crops is 1.5%, the maximum premium percentage payable by farmers for annual commercial and horticultural crops is fixed at 5.0%.

48. (A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
Legalizing agricultural land leasing is widely recognized as a critical rural development reform because informal leasing arrangements leave sharecroppers excluded from institutional assistance. Formalizing lease agreements provides legal security to landowners while enabling tenant farmers to utilize formal lease documents to secure institutional credit, crop insurance, and government subsidy benefits.

49. (A) By conducting standard Crop Cutting Experiments (CCEs) in notified areas
Under the Pradhan Mantri Fasal Bima Yojana, determining actual yield levels to assess widespread agricultural losses relies on conducting standardized Crop Cutting Experiments in notified insurance units. CCEs involve physical harvesting and weighing of crops within scientifically selected sample plots, providing objective statistical yield data necessary to compute insurance claims.

50. (C) Deviations in weather parameters like rainfall and temperature from set thresholds
The Weather Based Crop Insurance Scheme functions as a parametric insurance mechanism designed to protect farmers against adverse micro-climatic fluctuations. Unlike yield-estimation schemes that rely on physical crop sampling, claim payouts under WBCIS are triggered automatically when recorded weather parameters deviate beyond predetermined historical threshold levels at local weather stations.

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51. (A) Indian Council of Agricultural Research (ICAR)
Launched in February 2011, National Innovations on Climate Resilient Agriculture is a flagship network project initiated by the Indian Council of Agricultural Research. NICRA aims to enhance the resilience of Indian agriculture to climate variability through integrated strategic research, technology demonstrations, capacity building, and promoting adaptive soil and crop technologies.

52. (D) Promoting Integrated Farming Systems (IFS) to enhance productivity and mitigate climate risks
The Rainfed Area Development component under the National Mission for Sustainable Agriculture

focuses on optimizing resource utilization in rainfed regions. It promotes Integrated Farming Systems that combine crop cultivation with livestock, horticulture, and agroforestry. This multi-component approach diversifies household income, enhances soil health, and mitigates climate-induced crop failure risks effectively.

53. (B) It conserves soil moisture and suppresses weeds, reducing irrigation needs.
Trash mulching in sugarcane farming involves retaining and spreading dried crop residues over inter-row spaces. This practice forms an insulating organic protective blanket over the soil surface, which suppresses weed emergence, significantly minimizes water evaporation, conserves residual soil moisture, regulates soil temperature, and reduces total irrigation water requirements during cultivation.

54. (C) Double India's agricultural exports to US$ 60 billion
The Agriculture Export Policy 2018 was formulated by the Government of India with a strategic financial vision to integrate Indian agricultural producers with global value chains. The central objective of the policy was to double agricultural exports from approximately US$ 30 billion to US$ 60 billion within the designated timeframe.

55. (D) P-3, Q-1, R-2, S-4
Zero Tillage minimizes mechanical soil disturbance and aids moisture retention. Drip Irrigation maximizes water use efficiency by delivering water directly to crop roots. Contour Bunding involves constructing earthen embankments along contours to prevent soil erosion on slopes. Seed Treatment protects planting setts against early soil-borne fungal infections and lethal diseases.

56. (A) One District, One Product
Under the Atmanirbhar Bharat Abhiyan package, the PM Formalisation of Micro Food Processing Enterprises scheme was launched to support micro food units. The scheme adopts the 'One District, One Product' framework to leverage scale advantages in input procurement, common processing facilities, product branding, and marketing for identified local district commodities.

57. (B) Animal Husbandry Infrastructure Development Fund
As part of the Atmanirbhar Bharat stimulus package, the central government established the Animal Husbandry Infrastructure Development Fund. The fund provides financial credit incentives and interest subventions to private businesses, FPOs, and enterprise units to set up processing, value addition, and animal feed infrastructure plants in rural commercial farming regions.

58. (A) I and II
The Agriculture Export Policy 2018 focuses on strategic interventions to expand India's agricultural exports. Key measures include setting up institutional mechanisms to overcome international Sanitary and Phytosanitary trade barriers, developing specialized export-oriented produce clusters, and actively promoting private commercial investment across all stages of export supply chain networks nationwide today.

59. (A) Tomato, Onion, and Potato
Operation Greens was announced in the 2018–19 Union Budget on the lines of Operation Flood to stabilize seasonal price volatility in perishable crops. Initially, the scheme targeted Tomato, Onion, and Potato by offering financial support for post-harvest logistics, processing, and cold storage infrastructure before expanding to all horticultural seasonal produce.

60. (C) I and III
The Dalwai Committee on Doubling Farmers' Income advocated a fundamental paradigm shift from focusing solely on gross agricultural production to maximizing net real farm income. The committee emphasized enhancing resource use efficiency to minimize input costs, improving market realizations, and diversifying revenue streams across diverse agricultural and allied farm activities.

61. (D) Gross cropped area divided by net sown area, multiplied by 100
Cropping intensity is a standard agronomic metric used to quantify the extent to which net sown land area is cultivated repeatedly during a single farming year. Mathematically, cropping intensity is calculated as the total Gross Cropped Area divided by the Net Sown Area, multiplied by one hundred percent overall always.

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8. (A) I, II and IV
The Zamindari Abolition Act eliminated intermediary rent collectors to establish direct relations between the state and tillers. Consolidation of land holdings consolidates fragmented plots into single contiguous units, enhancing operational efficiency. Digitalization of land records through the Bhulekh portal ensures transparency and minimizes rural ownership litigation. However, state revenue laws enforce land ceiling limits, strictly prohibiting farmers from acquiring unlimited agricultural land without restriction.

9. (C) 18 percent
Under Priority Sector Lending norms issued by the Reserve Bank of India, domestic commercial banks are obligated to allocate a minimum target of 18 percent of their Adjusted Net Bank Credit or Credit Equivalent Amount of Off-Balance Sheet Exposure to the agriculture sector. Within this mandatory target, sub-targets are specified for small and marginal farmers to guarantee adequate flow of formal credit to vulnerable rural agricultural producers.

10. (B) An apex refinancing institution for agricultural and rural credit
Established in 1982, the National Bank for Agriculture and Rural Development serves as the apex refinancing institution for rural credit delivery infrastructure. Rather than lending directly to individual farmers, NABARD provides refinance assistance, policy direction, and capital resources to state cooperative banks, regional rural banks, commercial financial institutions, and primary credit societies to promote sustainable rural development and credit accessibility.

11. (A) India had to classify its agricultural subsidies into Amber, Blue, and Green Boxes.
The World Trade Organization's Agreement on Agriculture required member nations to categorize domestic agricultural support programs into distinct regulatory boxes based on their trade-distorting impacts. Under these guidelines, India categorized its farm support into Green Box non-distorting measures, Blue Box direct production-limiting payments, and Amber Box price support and input subsidies, ensuring compliance with international trade frameworks while maintaining domestic agricultural welfare support.

12. (C) I and III
The Kisan Credit Card scheme provides farmers with flexible short-term financial limits to cover operational costs for crop production, post-harvest expenses, maintenance of farm assets, and domestic requirements. Credit limits are determined based on land holdings, cropping patterns, and scales of finance. Furthermore, eligibility for the card scheme has been expanded to include farmers engaged in animal husbandry, poultry, and fisheries activities.

13. (D) WTO commitments and economic liberalization policies
In April 2001, India eliminated Quantitative Restrictions on the import of numerous agricultural and industrial items to fulfill its multilateral obligations under the World Trade Organization guidelines and economic liberalization policies. Replacing non-tariff quantitative quotas with protective tariff structures allowed India to harmonize its international trade policies while reserving legal rights to adjust import duties to safeguard domestic agricultural producers from global price shocks.

14. (C) To consolidate Panchayat and Municipality plans into a draft district development plan
Constituted under Article 243ZD of the Indian Constitution, the District Planning Committee serves as a statutory body responsible for consolidating individual development plans prepared by local Panchayats and Municipalities within the district. In systematic agricultural planning, the committee integrates local spatial designs, natural resource management, infrastructure development, and sector-specific targets into a comprehensive draft district development plan for unified execution.

15. (B) Planning starts at the grass-root level with Gram Panchayats and moves upward to the state.
The bottom-up approach in agricultural plan formulation emphasizes decentralized planning that originates at the grass-root level with active community participation. Local farming needs, resource mapping, and agro-ecological constraints are initially identified by Gram Sabhas and Gram Panchayats. These localized micro-plans are systematically consolidated at the block, district, and state levels, ensuring that agricultural policy interventions accurately address context-specific ground realities.

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72. (A) P-3, Q-2, R-1, S-4
Fair and Remunerative Price is the central statutory minimum price benchmark tied to sugar recovery. State Advised Price is the elevated price declared by state governments. Recovery Percentage represents the proportion of sugar extracted per unit of crushed cane. A Parchi is the supply ticket issued detailing cane delivery schedules.

73. (B) Ensuring transparency in cane supply slips (Parchi) and supply calendar management
The Uttar Pradesh Sugarcane Department introduced the E-Ganna mobile application and web portal to digitalize administrative operations in the sugar sector. The platform eliminated middleman exploitation by providing real-time digital access to cane supply calendars, purchasing indents, weighing receipts, and payment status, thereby ensuring complete transparency for all state growers.

74. (B) Pratappur, Uttar Pradesh
India's modern sugar manufacturing industry originated in 1903 with the establishment of the country's first successful vacuum-pan technology sugar mill at Pratappur in Deoria district, Uttar Pradesh. This historic industrial development catalyzed the expansion of commercial sugarcane cultivation and processing across northern India, establishing the modern commercial sugar processing sector.

75. (A) I and II
The Uttar Pradesh Sugarcane Act of 1953 regulates the supply, distribution, and purchase of sugarcane for sugar factories and khandsari units. It provides for establishing local Cane Development Councils to promote infrastructure and cane welfare. However, mills cannot procure cane outside reserved zones without explicit legal permission from state authorities.

76. (C) Sugar Cogeneration and Distillery Policy
To promote ethanol blending targets and enhance the financial liquidity of sugar mills, Uttar Pradesh implemented the Sugar Cogeneration and Distillery Policy. This strategic framework encourages sugar mills to establish attached bagasse-based cogeneration power plants and ethanol distilleries, transforming sugar mills into integrated eco-friendly multi-product renewable energy complexes state-wide sustainable.

77. (C) 15 km
Under regulatory guidelines established under statutory licensing provisions enforced in Uttar Pradesh, a minimum radial distance of 15 kilometers must be maintained between an existing operational sugar mill and any proposed new sugar factory. This distance restriction ensures adequate sugarcane raw material availability for established processing units across farming zones.

78. (C) Rs. 5 Lakh
The Uttar Pradesh Government launched the Mukhya Mantri Krishak Durghatna Kalyan Yojana to extend financial social security to resident farming households. Under this welfare scheme, if an eligible farmer or registered agricultural worker suffers accidental death or total permanent disability, financial assistance of up to Rs. 5 Lakh is provided.

79. (A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
Uttar Pradesh emerged as India's leading sugar manufacturer, repeatedly outperforming Maharashtra in annual sugar production. This transformation was driven by the widespread adoption of Co-0238, an early-maturing, high-sugar, high-yielding sugarcane variety. Variety Co-0238 significantly enhanced field cane yields per hectare and boosted average sugar recovery rates state-wide, justifying the assertion.

80. (C) 5.1%
The State Agriculture Policy 2013 of Uttar Pradesh, commonly known as the Agribusiness and Agriculture Policy, set an ambitious target of achieving a 5.1% annual growth rate in the agriculture and allied sector. The policy aimed to transform Uttar Pradesh into a leading agricultural hub by promoting productivity and agribusiness.

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59. If a country exports ₹50,000 crore worth of agricultural goods and imports ₹70,000 crore worth of agricultural goods, its agricultural trade balance is?
(A) A surplus 1of ₹20,000 crore
(B) A surplus of ₹1,20,000 crore
(C) A deficit of ₹1,20,000 crore
(D) A deficit of ₹20,000 crore

60. Match the agricultural commodity in List I with its globally leading exporting country in List II:
List I: (Commodity)
P. Soybeans
Q. Palm Oil
R. Basmati Rice
S. Wheat
List II: (Exporting Country)
1. Indonesia
2. India
3. Brazil
4. Russia
(A) P-3, Q-1, R-2, S-4
(B) P-1, Q-3, R-4, S-2
(C) P-3, Q-2, R-1, S-4
(D) P-4, Q-1, R-2, S-3

61. The Agri Export Zone specifically established for potatoes in Uttar Pradesh is primarily centered around which district?
(A) Varanasi
(B) Agra
(C) Meerut
(D) Gorakhpur

62. To assist sugar mills in clearing heavy cane arrears owed to farmers, the Central Government has historically provided which of the following mechanisms?
(A) Complete waiver of all corporate income taxes for a period of 10 years
(B) Transport subsidy for sugar export
(C) Direct bulk import of raw sugarcane stalk directly from Brazil
(D) Completely abolishing the Fair and Remunerative Price (FRP) system

63. MRL is a critical quality standard checked when exporting fresh fruits and vegetables. What does MRL stand for?
(A) Maximum Residue Limit
(B) Minimum Required Length
(C) Marginal Revenue Level
(D) Maximum Ripening Limit

64. Geographical Indication (GI) tags help in agricultural export promotion primarily by?
(A) Waiving off all customs tariffs and import duties across international trade
(B) Completely eliminating the statutory requirement for phytosanitary certificates
(C) Preventing unauthorized use of regional product names
(D) Guaranteeing fixed and non-volatile international market prices for the product

65. Consider the following statements regarding India's agricultural imports:
I. India is highly self-sufficient in pulses and never imports them.
II. Vegetable oils constitute the largest share of India's agricultural import bill.
III. Import duties on edible oils are frequently adjusted by the government to control domestic inflation.
Which of the given statements is/are correct?
(A) I and II only
(B) II and III only
(C) I and III only
(D) I, II and III

66. In terms of total agricultural export value, which country consistently ranks among the top two globally?
(A) Bangladesh
(B) South Africa
(C) USA
(D) Japan

67. Which Indian state is the largest contributor to the country's total sugarcane and sugar production, deeply influencing national trade and export policies?
(A) State of Maharashtra
(B) Uttar Pradesh
(C) State of Karnataka
(D) State of Tamil Nadu

68. A major logistical obstacle in directly exporting perishable agricultural commodities from Uttar Pradesh to foreign markets is?
(A) Persistent domestic overproduction of fresh horticultural fruits and vegetables
(B) Complete geographical unavailability of fertile agricultural land across the region
(C) Excessive over-reliance on traditional certified organic farming methodologies
(D) Inadequate sea port access and cold chain infrastructure

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(C) Third largest producer and third largest consumer
(D) Largest importer and smallest producer

10. Match the organization or scheme in List I with its primary trade role in List II:
List I: (Organization/Scheme)
P. APEDA
Q. WTO
R. NCDEX
S. ODOP
List II: (Trade Role)
1. Global trade rules
2. Agricultural export promotion
3. Regional product branding
4. Commodity futures trading
(A) P-2, Q-1, R-4, S-3
(B) P-1, Q-2, R-3, S-4
(C) P-4, Q-3, R-2, S-1
(D) P-2, Q-4, R-1, S-3

11. The international body recognized under the WTO's SPS agreement for setting global food safety standards is?
(A) World Health Organization (WHO)
(B) Food and Agriculture Organization (FAO)
(C) International Organization for Standardization (ISO)
(D) Codex Alimentarius Commission

12. What is an 'Anti-dumping duty' in international agricultural trade?
(A) A tariff on imports priced below fair value to protect domestic producers
(B) A penalty tax levied directly on domestic farmers for overproducing surplus crops
(C) A government subsidy provided to exporters to sell goods cheaply in foreign markets
(D) A regulatory fee collected from industries for discarding agricultural waste in oceans

13. When is the Agricultural Trade Balance of a country considered to be 'positive' or in surplus?
(A) When total agricultural imports significantly exceed total agricultural exports
(B) When the value of agricultural exports exceeds that of imports
(C) When the total value of agricultural exports equals total agricultural imports
(D) When a nation completely halts all international agricultural trade activities

14. The platform primarily used for agricultural commodity futures trading in India is?
(A) BSE
(B) NCDEX
(C) NSE
(D) RBI

15. Consider the following statements regarding the ODOP scheme in Uttar Pradesh:
I. It promotes traditional local products to boost their domestic and export potential.
II. Jaggery (Gur) is the designated ODOP product of Ayodhya and Muzaffarnagar.
III. It focuses entirely on heavy industrial machinery and strictly excludes agricultural products.
Which of the given statements is/are correct?
(A) I and III only
(B) I and II only
(C) II and III only
(D) I, II and III

16. The mandatory certificate required to prove that exported plants or plant products are free from quarantine pests is called?
(A) Eco-mark Certificate
(B) AGMARK Certificate
(C) Phytosanitary Certificate
(D) Geographic Indication Certificate

17. The apex body designated as the secretariat for the National Programme for Organic Production (NPOP) in India is?
(A) FSSAI
(B) ICAR
(C) NAFED
(D) APEDA

18. India's share in total global agricultural exports is approximately?
(A) Less than 1%
(B) Around 2 to 3%
(C) Around 10 to 12%
(D) More than 20%

19. The Government of India uses the "Monthly Release Mechanism" primarily to regulate which of the following?
(A) The duty-free export of basmati rice
(B) Domestic sales of sugar by mills
(C) The commercial import of chemical fertilizers
(D) The international spot trading of raw cotton

20. Consider the following statements regarding the export of sugar from India:
I. India exports both raw and white refined sugar.

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II. The government sometimes fixes a Maximum Admissible Export Quantity (MAEQ) for mills.
III. Sugar exports are entirely tax-free and completely unregulated by the government.
IV. High domestic cane prices (FRP/SAP) can make Indian sugar less competitive globally.
Which combination of statements is correct?
(A) I, II and III
(B) II, III and IV
(C) I, II and IV
(D) I, III and IV

21. How does a sudden government export ban on an agricultural commodity generally affect domestic farmers in the short term?
(A) It causes domestic prices to crash, reducing farmer income
(B) It increases the international demand for the crop
(C) It encourages farmers to immediately switch to organic farming
(D) It increases the cost of cultivation drastically

22. The term 'RoDTEP', frequently seen in trade policy to promote exports, stands for?
(A) Rebate on Domestic Transport and Export Produce
(B) Return on Domestic Trade and Export Promotion
(C) Remission of Duties and Taxes on Exported Products
(D) Regulation of Duties and Tariffs for Export Processing

23. The global benchmark prices for raw sugar are primarily determined at which international exchange?
(A) Intercontinental Exchange (ICE)
(B) London Metal Exchange (LME), United Kingdom
(C) Tokyo Commodity Exchange (TOCOM), Japan
(D) Multi Commodity Exchange (MCX), Mumbai, India

24. Which of the following is an example of a Non-Tariff Barrier (NTB) in agricultural trade?
(A) Imposing a steep 40% tariff duty on wheat imports
(B) Providing direct cash transfers to smallholder farmers
(C) Gradually reducing government agricultural export subsidies
(D) Strict pesticide Maximum Residue Limits (MRL)

25. Select the correct sequence of stages in the modern sugar manufacturing process.
(A) Milling → Clarification → Evaporation → Crystallization → Centrifugation
(B) Milling → Evaporation → Clarification → Crystallization → Centrifugation
(C) Clarification → Milling → Crystallization → Evaporation → Centrifugation
(D) Evaporation → Milling → Clarification → Centrifugation → Crystallization

26. Which nodal agency acts on behalf of the Government of India for the procurement and import of pulses to stabilize domestic prices?
(A) FCI
(B) APEDA
(C) NAFED
(D) IFFCO

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27. The 'Kisan Rail' scheme was launched by the Government of India primarily to?
(A) Provide subsidized rail tickets to farmers for nationwide agricultural study tours
(B) Transport heavy farm machinery and tractors free of freight charges across states
(C) Connect remote rural farming villages directly to major international cargo airports
(D) Ensure seamless cold chain transport for perishables nationwide

28. Match the Uttar Pradesh district in List I with its ODOP (One District One Product) agricultural/ food item in List II:
List I: (District)
P. Siddharthnagar
Q. Pratapgarh
R. Hathras
S. Gonda
List II: (Product)
1. Asafoetida (Hing)
2. Pulses
3. Kala Namak Rice
4. Aonla (Amla)
(A) P-3, Q-4, R-1, S-2
(B) P-4, Q-3, R-2, S-1
(C) P-3, Q-1, R-4, S-2
(D) P-2, Q-4, R-1, S-3

29. What is the main objective of the 'Krishi Udan' scheme?
(A) To provide subsidized agricultural drones to

farmers for precision pesticide spraying
(B) To assist in air-transporting farm goods to national and global markets
(C) To monitor real-time crop health and soil moisture using high-altitude satellites
(D) To eradicate aerial pests and fungal diseases affecting sugarcane crops nationwide

30. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): Sugarcane is rarely traded internationally in its raw stalk form.
Reason (R): Sugarcane deteriorates quickly after harvesting and has a high bulk-to-value ratio.
(A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
(B) Both Assertion (A) and Reason (R) are true but R is not the correct explanation of A.
(C) Assertion (A) is true but Reason (R) is false.
(D) Assertion (A) is false but Reason (R) is true.

31. If an FTA partner country exports highly subsidized agricultural products to India at zero import duty, what is the most likely impact?
(A) Domestic farmers face severe price competition and revenue losses
(B) Domestic farmers systematically earn significantly higher profit margins from exports
(C) The overall soil health and ecological quality of Indian farmlands automatically improves
(D) Direct agricultural subsidies provided to local farmers in India are automatically doubled

32. For exporting jaggery (Gur) to premium international markets, which chemical parameter must be strictly monitored and kept to a minimum?
(A) Calcium carbonate
(B) Sodium chloride
(C) Sulphur dioxide
(D) Magnesium sulphate

33. Under the ODOP scheme, 'Kala Namak Rice' is being branded and heavily promoted for export from which district of Uttar Pradesh?
(A) Gorakhpur
(B) Varanasi
(C) Lucknow
(D) Siddharthnagar

34. Which pulse constitutes a major portion of India's total pulse imports?
(A) Chickpea (Chana)
(B) Green gram (Moong)
(C) Pigeon pea (Tur)
(D) Black gram (Urad)

35. Match the quality certification mark in List I with its correct application area in List II:
List I: (Certification Mark)
P. AGMARK
Q. FSSAI
R. ISO 22000
S. India Organic
List II: (Application Area)
1. Food Safety Standards in India
2. Agricultural Commodity Grading
3. Organic Product Export Standard
4. Food Safety Management System
(A) P-1, Q-2, R-3, S-4
(B) P-2, Q-1, R-4, S-3
(C) P-4, Q-3, R-2, S-1
(D) P-3, Q-4, R-1, S-2

36. What does 'MSP' stand for in the context of legal domestic sales of sugar by mills in India?
(A) Maximum Subsidy Price
(B) Minimum Support Price
(C) Marginal Sales Profit
(D) Minimum Selling Price

37. The Sanitary and Phytosanitary (SPS) measures under the WTO primarily aim to protect?
(A) Human, animal, or plant health from international trade risks
(B) The trade secrets and proprietary technologies of multinational seed corporations
(C) Developing partner nations from paying excessively high import tariffs and duties
(D) The intellectual property rights of international agricultural machinery manufacturers

38. If international sugar prices rise sharply, what step does the Indian Government typically take to control domestic food inflation?
(A) Provide higher transport and export subsidies directly to domestic sugar mills
(B) Ban all commercial imports of raw and refined sugar completely from foreign nations
(C) Impose export duties or quantitative caps on exports
(D) Substantially increase the domestic GST tax rate applicable on refined sugar sales

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CHAPTER 24

Agricultural Commodity Trade : Import and Export

1. Which of the following is the primary reason for a country to import agricultural commodities?
(A) To generate maximum foreign exchange
(B) To permanently replace domestic agricultural production
(C) To increase the cost of raw materials for domestic industries
(D) To meet domestic consumption shortfalls and stabilize local prices

2. What is the main economic benefit of exporting agricultural products for the Indian economy?
(A) It reduces the domestic supply of essential foodgrains
(B) It eliminates the need for agricultural subsidies
(C) It brings in valuable foreign exchange and boosts rural incomes
(D) It increases the import tariffs on industrial goods

3. Among the following, which agricultural product consistently earns the highest foreign exchange for India?
(A) Raw Cotton
(B) Basmati Rice
(C) Fresh Fruits
(D) Jaggery

4. Which of the following occupies the highest share in terms of import value in India's agricultural import basket?
(A) Fresh vegetables
(B) Wheat
(C) Spices
(D) Edible oils

5. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): India imports edible oils in large quantities.
Reason (R): Domestic production of oilseeds is insufficient to meet the rising consumer demand.
(A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
(B) Both Assertion (A) and Reason (R) are true but R is not the correct explanation of A.
(C) Assertion (A) is true but Reason (R) is false.
(D) Assertion (A) is false but Reason (R) is true.

6. What is the primary objective of the Agriculture Export Policy (AEP) 2018 of India?
(A) To strictly prohibit the export of all raw agricultural commodities to preserve domestic supply
(B) To systematically increase the import of essential cash crops from neighboring trade partners
(C) To double agricultural exports and integrate farmers globally
(D) To completely eliminate the domestic Minimum Support Price (MSP) system for crops

7. The nodal agency responsible for the promotion of export of agricultural and processed food products from India is?
(A) APEDA
(B) NABARD
(C) FCI
(D) NITI Aayog

8. In the context of WTO rules, which "Box" contains agricultural subsidies that are considered trade-distorting and must be reduced?
(A) Green Box
(B) Blue Box
(C) Red Box
(D) Amber Box

9. What is India's general position in the global sugar market regarding production and consumption?
(A) Largest producer and second largest consumer
(B) Second largest producer and largest consumer

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(B) Value Added Tax
(C) Import Tariff
(D) Corporate Tax

49. A sugarcane farmer cooperative wants to lock in a future selling price for its jaggery produce to avoid potential losses from a sudden price drop. What financial mechanism is best suited for this?
(A) Speculating in the spot market
(B) Securing an overdraft facility from a bank
(C) Purchasing crop weather insurance
(D) Hedging via commodity futures contracts

50. Arrange the following basic steps of the agricultural export process in the correct chronological order:
1. Obtaining an Importer-Exporter Code (IEC)
2. Customs clearance and shipping
3. Receiving an international order from a buyer
4. Pre-shipment quality inspection and certification

(A) 1, 3, 4, 2
(B) 3, 1, 4, 2
(C) 1, 4, 3, 2
(D) 4, 1, 3, 2

51. India imports a significant share of its crude palm oil requirement from which of the following countries?
(A) USA and Canada
(B) Indonesia and Malaysia
(C) Australia and New Zealand
(D) Brazil and Argentina

52. NPOP, the standard framework for exporting organic products from India, stands for?
(A) National Policy on Organic Produce
(B) Nodal Plan for Organic Processing
(C) National Project on Organic Plantations
(D) National Programme for Organic Production

53. Which Export Promotion Council handles the export of cashew nuts from India?
(A) CEPCI
(B) APEDA
(C) MPEDA
(D) Spices Board

54. "Reefer" containers, frequently used in the export of fresh agricultural commodities, refer to?
(A) Specialized cargo containers equipped with internal automated grain silos
(B) Heavy-duty reusable eco-friendly jute bags for bulk export storage
(C) Refrigerated shipping containers for perishable goods
(D) Standard containers used exclusively for transporting dry chemical fertilizers

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55. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): The branding of agricultural products with Geographical Indications (GI) boosts their international export value.
Reason (R): GI tags assure international buyers of the specific geographical origin and the unique traditional qualities of the product.
(A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
(B) Both Assertion (A) and Reason (R) are true but R is not the correct explanation of A.
(C) Assertion (A) is true but Reason (R) is false.
(D) Assertion (A) is false but Reason (R) is true.

56. What is the primary metric used to differentiate between raw sugar and refined white sugar in international trade?
(A) Moisture percentage
(B) Total reducing sugars
(C) Brix percentage
(D) ICUMSA value

57. The color and purity of sugar traded in international markets are universally measured using which scale?
(A) Standard Brix scale
(B) ICUMSA scale
(C) Sucrose Pol scale
(D) Commercial CCS scale

58. Consider the following statements regarding Free Trade Agreements (FTAs):
I. FTAs aim to eliminate or significantly reduce import tariffs between member nations.
II. FTAs automatically remove all Sanitary and Phytosanitary (SPS) safety checks for agricultural imports.
III. FTAs can lead to an influx of cheap agricultural imports if adequate safeguard mechanisms are not implemented.

Which of the given statements is/are correct?
(A) I and II only
(B) I and III only
(C) II and III only
(D) I, II and III

39. The Agricultural and Processed Food Products Export Development Authority (APEDA) was established by an Act of Parliament in which year?
(A) 1972
(B) 1985
(C) 1995
(D) 2005

40. Consider the following statements about agricultural futures trading:
I. It aids in advance price discovery for crops before harvest.
II. It allows farmers and traders to hedge against future price risks.
III. Every futures contract must end with the physical delivery of the crop.
Which of the given statements is/are correct?
(A) I and II only
(B) I and III only
(C) II and III only
(D) I, II and III

41. What is the primary cause of sudden, widespread price fluctuations of agricultural commodities in the international market?
(A) Gradual, long-term shifts in global dietary habits and consumer preferences over decades
(B) Shifts in global supply and demand caused by weather events
(C) Implementation of fixed minimum support prices exclusively in developing nations
(D) Widespread structural transitioning to sustainable organic farming methods locally

42. How does a continuous increase in the Fair and Remunerative Price (FRP) of sugarcane generally affect India's sugar export potential without subsidies?
(A) It drastically lowers the overall refining quality and purity of the sugar produced
(B) It automatically forces foreign importing countries to pay premium prices in contracts
(C) It increases production costs, reducing global competitiveness
(D) It significantly increases the average sucrose recovery rate achieved in sugar mills

43. MAEQ, an acronym often used in India's sugar trade policies, stands for?
(A) Minimum Acceptable Export Quota
(B) Marginal Agricultural Export Quantity
(C) Minimum Assured Export Quality
(D) Maximum Admissible Export Quantity

44. Which fruit from Uttar Pradesh has a dedicated Agri Export Zone covering the districts of Lucknow and Saharanpur?
(A) Mango
(B) Guava
(C) Banana
(D) Litchi

45. Consider the following statements regarding the WTO Agreement on Agriculture (AoA):
I. It aims to reduce trade barriers and trade-distorting agricultural subsidies.
II. Market access, domestic support, and export competition are its three main pillars.
III. The 'Green Box' contains subsidies that are highly trade-distorting and strictly prohibited.
IV. Developing countries are provided special and differential treatment.
Which combination of statements is correct?
(A) I, II and III
(B) II, III and IV
(C) I, II and IV
(D) I, III and IV

46. What is the primary purpose of 'Modified Atmosphere Packaging' (MAP) when exporting perishable agricultural commodities?
(A) To completely sterilize the harvested produce using high-frequency ionizing radiation
(B) To extend shelf life by altering internal package gas composition
(C) To vacuum seal the perishable product completely without leaving any internal gas behind
(D) To thoroughly dip the harvested produce in concentrated liquid chemical fungicide solutions

47. Which WTO Box includes agricultural subsidies that cause minimal or no trade distortion, such as government funding for pest control and agricultural research?
(A) Green Box
(B) Amber Box
(C) Blue Box
(D) Red Box

48. A tax applied by a government on imported agricultural goods to make them more expensive than domestic goods is known as?
(A) Export Subsidy

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69. Which Indian state was declared as the country's first fully organic state, setting a benchmark for premium organic agricultural exports?
(A) Sikkim
(B) Kerala
(C) Punjab
(D) Uttarakhand

70. Consider the following statements about APEDA:
I. It functions under the direct administrative control of the Ministry of Agriculture and Farmers Welfare.
II. It is mandated to promote the export of scheduled products like fruits, vegetables, meat, and poultry.
III. It provides financial assistance to exporters for infrastructure and quality development.
IV. It sets standards and specifications for its scheduled products.
Which combination of statements is correct?
(A) I, II and III
(B) II, III and IV
(C) I, II and IV
(D) I, III and IV

71. Suddenly reducing the import duty on refined edible oils directly leads to which of the following domestic outcomes?
(A) Lower domestic oil prices, squeezing local oilseed farmers' margins
(B) An immediate and sharp increase in the retail price of domestically produced edible oils
(C) A rapid, significant increase in the international export volume of raw mustard seeds
(D) A complete and permanent halt in all domestic industrial oilseed crushing operations

72. Sugar exported from India as high-quality white refined sugar typically requires a minimum polarization (sucrose content) percentage of?
(A) 96.0%
(B) 98.5%
(C) 99.8%
(D) 100.5%

73. What does 'Dumping' mean in the context of international agricultural trade?
(A) Systematically discarding low-grade or spoiled agricultural produce into international ocean waters
(B) Selling a product in a foreign market below its normal domestic price
(C) Over-applying synthetic chemical fertilizers to artificially boost total crop yield for export
(D) Mass hoarding essential agricultural commodities to artificially inflate prevailing global market prices

74. Which statutory body is responsible for recommending the Fair and Remunerative Price (FRP) of sugarcane to the Government of India?
(A) APEDA
(B) NITI Aayog
(C) CACP
(D) ICAR

75. Select the correct sequence of India's major agricultural exports in descending order of value, based on general recent trends.
(A) Marine products > Non-Basmati Rice > Basmati Rice > Spices
(B) Spices > Marine products > Basmati Rice > Non-Basmati Rice
(C) Basmati Rice > Spices > Marine products > Non-Basmati Rice
(D) Non-Basmati Rice > Marine products > Spices > Basmati Rice

76. Which of the following is NOT an objective of India's current agricultural trade policy?
(A) To heavily tax farm exports to discourage trade
(B) To maximize foreign exchange earnings from international trade surplus
(C) To integrate domestic agricultural sectors with global value-added supply chains
(D) To promote the export of high-value processed and certified organic farm products

77. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): The One District One Product (ODOP) scheme has increased the export potential of processed foods from Uttar Pradesh.
Reason (R): ODOP focuses on localized quality improvement, standard packaging, and geographical branding of district specialties.
(A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
(B) Both Assertion (A) and Reason (R) are true but R is not the correct explanation of A.
(C) Assertion (A) is true but Reason (R) is false.

(D) Assertion (A) is false but Reason (R) is true.

78. In the context of the WTO Agreement on Agriculture, the 'Blue Box' refers to?
(A) Subsidies tied strictly to environmental protection and conservation schemes only
(B) Subsidies tied to production-limiting programs
(C) Direct, unrestricted government export subsidies provided to domestic trading firms
(D) Direct financial subsidies for importing heavy agricultural equipment and machinery

79. Which among the following is a major administrative risk faced by Indian agricultural exporters trying to establish long-term international markets?
(A) Abrupt changes in trade policies and sudden export bans
(B) Excessively long biological crop life cycles that delay harvesting schedules
(C) Statutory requirement for mandatory 100% organic certification across all crops
(D) Complete and total absence of functional commercial sea ports along the coastline

80. The process of converting raw sugarcane juice into export-quality crystalline white sugar involves 'clarification'. Which chemical combination is commonly used in modern sugar mills for this purpose?
(A) Sodium hydroxide and Hydrochloric acid
(B) Potassium permanganate and Chlorine
(C) Milk of lime and Sulphur dioxide gas
(D) Calcium carbonate and Acetic acid

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ANSWERS

1. (D) To meet domestic consumption shortfalls and stabilize local prices
Countries import agricultural commodities primarily to address domestic production deficits and prevent supply shortages. When local yields fall short of national consumption demands, imports help maintain a steady food supply across markets. This intervention stabilizes local prices, prevents inflation, protects consumers from extreme price volatility, and ensures overall food security throughout the nation.

2. (C) It brings in valuable foreign exchange and boosts rural incomes
Exporting agricultural products provides significant economic benefits by generating substantial foreign exchange reserves, which strengthen the national balance of payments. Additionally, accessing international markets creates higher demand for farm produce. This enables rural farming communities to secure better market prices, thereby increasing agrarian incomes, encouraging rural entrepreneurship, and driving overall economic development.

3. (B) Basmati Rice
Basmati rice is one of the highest foreign exchange earners among India's agricultural export commodities. Known globally for its unique aroma, long grain size, and superior cooking quality, it commands a premium price in international markets. High demand in Middle Eastern, European, and North American nations ensures consistent export revenues for the country annually.

4. (D) Edible oils
Edible oils account for the largest financial share of India's agricultural import bill. Due to rapid population growth, changing dietary habits, and stagnating domestic oilseed production, national demand significantly exceeds domestic output. To bridge this structural supply gap, India regularly imports massive volumes of crude palm, soybean, and sunflower oils from global markets.

5. (A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
India relies heavily on imported edible oils because domestic oilseed cultivation cannot meet the country's expanding consumer requirements. Rising population levels and growing income standards have elevated per capita consumption, outstripping local supply. Consequently, large-scale imports are necessary to fill the demand gap, making the insufficient domestic oilseed production the direct explanation for these import volumes.

6. (C) To double agricultural exports and integrate farmers globally
The Agriculture Export Policy of 2018 was formulated with the strategic objective of doubling India's agricultural exports and integrating domestic farmers into global value chains. The policy focuses on diversifying export baskets, boosting high-value agricultural production, improving infrastructure, eliminating trade barriers, and linking rural producers directly with international markets to enhance farm income.

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(A) APEDA
The Agricultural and Processed Food Products Export Development Authority functions as the primary government organization for promoting Indian agricultural trade. Functioning under the Ministry of Commerce and Industry, it assists exporters by facilitating market access, providing financial assistance, setting quality standards, organizing international trade fairs, and developing export-oriented infrastructure across the country.

8. (D) Amber Box
Under World Trade Organization regulations, the Amber Box contains domestic support measures and subsidies that directly distort international trade and market prices. These include government interventions like price supports, input subsidies on fertilizers, power, and irrigation. WTO provisions require member nations to quantify and progressively reduce Amber Box subsidies exceeding defined aggregate measurement limits.

quantities of grains, soybeans, meat, cotton, and processed agricultural commodities to international markets annually.

67. (B) Uttar Pradesh
Uttar Pradesh is the leading state in India in terms of total sugarcane acreage and production, playing a decisive role in shaping national sugar output. Its extensive cultivated area and high density of sugar processing mills drive national production trends, heavily influencing central trade policies, domestic buffer stock allocations, and export quotas.

68. (D) Inadequate sea port access and cold chain infrastructure
A primary logistical challenge for exporting perishable farm produce from Uttar Pradesh is its landlocked geography, requiring long transport distances to reach maritime ports. This issue is compounded by gaps in integrated cold chain infrastructure, refrigerated transport, and packhouse facilities, which increases post-harvest spoilage risks and elevates transport expenses during international export operations.

69. (A) Sikkim
Sikkim was officially declared India's first fully organic state in 2016, having phased out synthetic chemical fertilizers and pesticides across its entire agricultural sector. This achievement established a benchmark for sustainable farming, enhancing the state's global reputation and opening high-value international export markets for certified organic crops like large cardamom and ginger.

70. (B) II, III and IV
APEDA is mandated to promote scheduled exports, provide financial assistance for quality development, and establish product standards. However, statement I is incorrect because APEDA operates under the administrative control of the Ministry of Commerce and Industry, not the Ministry of Agriculture. Therefore, statements II, III, and IV constitute the correct combination.

71. (A) Lower domestic oil prices, squeezing local oilseed farmers' margins
Reducing import duties on refined edible oils lowers the landed cost of imported foreign oil, increasing domestic market supply. While this lowers retail cooking oil prices for consumers, it depresses local market prices for domestic oilseeds. Consequently, domestic oilseed farmers and crushers face reduced profit margins, disincentivizing local oilseed cultivation over time.

72. (C) 99.8%
High-quality white refined sugar traded in international markets must meet strict purity standards, requiring a minimum sucrose polarization level of 99.8%. Polarization measures the percentage of pure sucrose present in the sugar mass using a polarimeter. High polarization indicates minimal moisture, ash, and residual non-sugar impurities, ensuring compliance with global specifications.

73. (B) Selling a product in a foreign market below its normal domestic price
Dumping refers to an unfair trade practice where an exporting country or firm sells a product in an overseas market at a price below its normal domestic selling price or cost of production. Used to dispose of surpluses or gain market share, dumping undermines domestic producers in the importing nation, often triggering anti-dumping duties.

74. (C) CACP
The Commission for Agricultural Costs and Prices is the statutory advisory body responsible for recommending the Fair and Remunerative Price for sugarcane in India. CACP evaluates factors like production costs, market demand, domestic and international price trends, inter-crop price parity, and sugar recovery rates before submitting pricing recommendations to the Central Government.

75. (A) Marine products $>$ Non-Basmati Rice $>$ Basmati Rice $>$ Spices
Marine products consistently generate the largest share of India's agricultural export value, followed closely by non-basmati rice due to massive global shipment volumes. Basmati rice ranks next, commanding premium pricing, followed by spices. Thus, the descending sequence of trade value is marine products, non-basmati rice, basmati rice, and spices.

76. (A) To heavily tax farm exports to discourage trade
Imposing heavy taxes on agricultural exports to discourage trade contradicts the core objectives of modern trade policy. Instead, policy aims to boost foreign exchange earnings, integrate

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wheat, spices, sugar, and milk, a vast portion of domestic farm yield is consumed internally to satisfy a large population. Strategic policies aim to modernize logistics and increase this trade share.

19. (B) Domestic sales of sugar by mills
The Monthly Release Mechanism is a regulatory tool utilized by the Indian government to control domestic sugar supply and price stability. Under this system, the government allocates specific quotas to sugar mills each month, dictating the quantity of sugar they can sell in the open domestic market, thereby preventing market flooding, hoarding, and excessive price fluctuations.

20. (C) I, II and IV
India exports both raw and refined sugar, with the government frequently assigning Maximum Admissible Export Quantities to mills to regulate export volumes. High statutory cane prices set by authorities increase raw material costs, making Indian sugar less competitive internationally without policy support. Because sugar trade is strictly regulated, describing it as completely unregulated is incorrect.

21. (A) It causes domestic prices to crash, reducing farmer income
Implementing an abrupt export ban on an agricultural commodity restricts supply to the domestic market, halting international shipments. This sudden accumulation of surplus produce locally increases domestic supply relative to demand. Consequently, wholesale market prices drop sharply, reducing farm-gate prices and significantly lowering financial returns for domestic farmers holding harvest stock in the short term.

22. (C) Remission of Duties and Taxes on Exported Products
RoDTEP stands for Remission of Duties and Taxes on Exported Products. It is a key trade incentive scheme introduced by the Government of India to refund non-creditable central, state, and local taxes or duties incurred during the manufacturing and distribution of exported goods. This process enhances the international competitiveness of Indian agricultural and industrial exports.

23. (A) Intercontinental Exchange (ICE)
The benchmark international prices for raw sugar trading are established at the Intercontinental Exchange, specifically through the Sugar No. 11 futures contract traded in New York. This financial exchange serves as the global standard for pricing physical raw sugar contracts, providing liquidity, market transparency, price discovery, and risk management tools for international trade participants.

24. (D) Strict pesticide Maximum Residue Limits (MRL)
Non-Tariff Barriers are administrative, technical, or regulatory restrictions other than custom tariffs used to restrict international trade. Enforcing strict pesticide Maximum Residue Limits on imported produce represents a sanitary non-tariff measure. While designed to protect public health, highly restrictive safety standards can act as trade obstacles by restricting entry of foreign farm commodities.

25. (A) Milling → Clarification → Evaporation → Crystallization → Centrifugation
Modern sugar manufacturing follows a structured sequential process. First, sugarcane is crushed during milling to extract raw juice. The juice undergoes clarification to remove impurities, followed by evaporation to concentrate it into thick syrup. Next, crystallization turns the syrup into sugar crystals, which are finally separated from remaining molasses through high-speed centrifugation.

26. (C) NAFED
The National Agricultural Cooperative Marketing Federation of India serves as the central agency for procuring and managing strategic buffer stocks of pulses. When domestic production falls short, NAFED handles pulse imports and open-market interventions under government mandates. These actions stabilize retail prices, prevent market hoarding, and protect consumer interests across domestic markets.

27. (D) Ensure seamless cold chain transport for perishables nationwide
The Kisan Rail initiative was introduced by the Indian Railways to build a seamless cold chain logistics network across the nation. Equipped with refrigerated and temperature-controlled coaches, these trains transport perishable agricultural produce like fruits, vegetables,

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goods to endure long transit times without quality deterioration.

47. (A) Green Box
The Green Box under WTO trade regulations includes domestic agricultural support programs that cause minimal or no market distortion. These subsidies are publicly funded and do not involve direct price supports. Examples include government funding for agricultural research, pest control management, infrastructure development, environmental protection programs, and direct income support decoupled from production levels.

48. (C) Import Tariff
An import tariff is a financial tax levied by a government on foreign products entering the country. Applied to imported agricultural commodities, tariffs increase the retail price of foreign goods, protecting domestic farmers from cheap international competition, raising national fiscal revenue, and helping regulate the domestic balance of agricultural supply and demand.

49. (D) Hedging via commodity futures contracts
Cooperatives can protect themselves against future price declines by hedging through agricultural commodity futures contracts on recognized exchanges. By locking in a binding sales price in advance for future delivery, the seller mitigates the financial risk of falling spot prices at harvest time, ensuring income predictability and financial stability for participating member farmers.

50. (A) 1, 3, 4, 2
The agricultural export process follows a structured sequence. An exporter must first obtain an Importer-Exporter Code from trade authorities. After receiving a buyer's order, the exporter prepares the consignment and undergoes pre-shipment quality inspection and health certification. Finally, the goods undergo customs clearance procedures prior to international shipping.

51. (B) Indonesia and Malaysia
India imports the vast majority of its crude palm oil from Indonesia and Malaysia, the world's leading palm oil exporters. Tropical climatic conditions in Southeast Asia facilitate large-scale oil palm plantations, enabling cost-effective production. These imports meet India's large domestic edible oil deficit and satisfy high consumer demand across processing industries.

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52. (D) National Programme for Organic Production
NPOP stands for the National Programme for Organic Production. Administered by the Ministry of Commerce and Industry, it provides the regulatory framework and standard operating procedures for organic certification in India. It accredits inspection bodies, sets standards for organic farming, and facilitates international recognition of Indian organic exports through trade agreements.

53. (A) CEPCI
The Cashew Export Promotion Council of India is the dedicated governmental body mandated to promote, extend, and expand the export of cashew kernels and cashew nut shell liquid. Established by the Ministry of Commerce, CEPCI maintains trade statistics, assists exporters, ensures quality control standards, and participates in international trade fairs.

54. (C) Refrigerated shipping containers for perishable goods
Reefer containers are specialized refrigerated cargo containers designed to maintain controlled temperature, humidity, and airflow conditions during transit. Essential for cold-chain logistics, they enable the long-distance transport and export of temperature-sensitive, perishable agricultural commodities such as fresh fruits, vegetables, meat, dairy, and seafood without thermal degradation or decay.

55. (A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
Geographical Indication tags enhance the export value of agricultural products by legally authenticating their origin and specific quality attributes linked to geographical environments. This designation builds consumer trust in global markets, protects against counterfeit imitation, and commands premium pricing, directly explaining why GI branding elevates the commercial and export market potential.

56. (D) ICUMSA value
The ICUMSA value is the universal metric used in global trade to determine the color, purity, and grade of sugar. Lower ICUMSA values signify higher purity, lower residual molasses, and whiter refined sugar, whereas higher values

rules for food safety and animal or plant health standards. It allows member countries to implement science-based regulations protecting humans, animals, and flora from risks associated with foreign pests, diseases, additives, toxins, and disease-causing organisms introduced through international trade.

38. (C) Impose export duties or quantitative caps on exports
When global sugar prices spike, domestic sugar mills are incentivized to maximize overseas exports, which can drain domestic availability and trigger local retail price inflation. To safeguard domestic consumers and stabilize local prices, the government intervenes by imposing export tariffs, setting quantitative export quotas, or temporarily restricting sugar exports to ensure adequate internal supply.

39. (B) 1985
The Agricultural and Processed Food Products Export Development Authority was established by the Parliament of India under the APEDA Act passed in December 1985. The authority officially came into effect in 1986, replacing the Processed Food Export Promotion Council to systematically develop and promote Indian agricultural exports worldwide.

40. (A) I and II only
Agricultural futures trading aids in forward price discovery and enables farmers, processors, and traders to hedge against price volatility risks. However, the majority of commodity futures contracts are cash-settled or offset before maturity rather than ending in physical delivery. Thus, statement III is inaccurate, making statement I and II the correct combination.

41. (B) Shifts in global supply and demand caused by weather events
Unexpected weather anomalies, including droughts, floods, early frosts, and heatwaves, are the primary drivers of global agricultural price volatility. Adverse weather abruptly damages crop yields in key producing regions, disrupting global supply expectations. Because food demand remains inelastic, even minor supply disruptions trigger sharp, immediate fluctuations in international commodity prices.

42. (C) It increases production costs, reducing global competitiveness
Consistently increasing the Fair and Remunerative Price for sugarcane raises the raw material procurement costs for domestic sugar mills. High raw material expenses elevate the base production cost of refined sugar. Without government export subsidies to bridge the gap, Indian sugar becomes costlier than competitor supplies, directly reducing its price competitiveness in global markets.

43. (D) Maximum Admissible Export Quantity
MAEQ stands for Maximum Admissible Export Quantity. Used in Indian sugar policy, it represents mill-wise export quotas allocated by the Central Government. The allocation encourages sugar mills to export surplus stock during bumper harvest seasons, reducing domestic excess, improving mill liquidity, and helping clear outstanding cane dues owed to farmers.

44. (A) Mango
Uttar Pradesh features dedicated Agri Export Zones specifically for mangoes, centered around key commercial producing belts like Lucknow and Saharanpur. Known for producing world-renowned cultivars like Dasheri and Langra, these designated zones provide targeted infrastructure, cold storage facilities, phytosanitary treatment, and export assistance to enhance international market penetration.

45. (C) I, II and IV
The WTO Agreement on Agriculture rests on three main pillars: market access, domestic support, and export competition, while granting special and differential treatment to developing nations. Statement III is false because Green Box subsidies cause minimal or no trade distortion and are non-actionable, making statement I, II, and IV the valid combination.

46. (B) To extend shelf life by altering internal package gas composition
Modified Atmosphere Packaging is a preservation technology used in fresh produce export to prolong shelf life. By altering the proportions of oxygen, carbon dioxide, and nitrogen inside sealed packaging, MAP reduces respiration rates, slows down enzymatic decay, and minimizes moisture loss, allowing perishable agricultural

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CHAPTER 25

Agricultural Statistics and Minimum Support Price

1. What is the fundamental objective of compiling agricultural statistics in India?
(A) To determine export taxes and regulatory import tariffs on agricultural goods
(B) To provide a reliable data foundation for policy, planning, and evaluation
(C) To calculate the daily wage rates and baseline welfare metrics for workers
(D) To track seasonal migration patterns and demographic shifts of farm labour

2. Which primary method is officially used in India to estimate the yield of major crops at the district and state levels?
(A) Crop Cutting Experiments (CCE)
(B) Farmer interview surveys
(C) Visual estimation by Patwaris
(D) Satellite imagery estimation alone

3. In the context of yield assessment through Crop Cutting Experiments (CCE), what is the typical standard plot size used for wheat and paddy in most states?
(A) 1 metre × 1 metre
(B) 5 metres × 5 metres
(C) 10 metres × 10 metres
(D) 20 metres × 20 metres

4. What is the basic statistical unit of data collection in the Agriculture Census of India?
(A) The individual farm labourer
(B) The rural household
(C) The revenue village
(D) The operational holding

5. Consider the following statements regarding the categories of farmers in the Agriculture Census:
I. Marginal farmers are those with an operational holding of less than 1.0 hectare.
II. Small farmers are those with an operational holding between 1.0 and 2.0 hectares.
III. Semi-medium farmers are those with an operational holding between 4.0 and 10.0 hectares.
Which of the above statements is/are correct?
(A) I and II only
(B) II and III only
(C) I and III only
(D) I, II, and III

6. If an agricultural statistician wants to find the most frequently occurring market price of sugarcane in a mandi on a given day, which measure of central tendency should be used?
(A) Arithmetic Mean
(B) Mode
(C) Geometric Mean
(D) Median

7. When calculating the average landholding size in a district where a few highly affluent farmers own extremely large tracts of land while the majority own very small plots, which measure provides the most realistic central value?
(A) Arithmetic Mean
(B) Mode
(C) Harmonic Mean
(D) Median

8. In agricultural statistics, the correlation coefficient between the amount of standard fertilizer applied (up to optimal limits) and crop yield is typically:
(A) Zero
(B) Negative
(C) Positive
(D) Infinite

9. What is the standard range of the correlation coefficient (r) when assessing the relationship between two agricultural variables, such as rainfall and crop production?
(A) 0 to +100
(B) -1 to +1
(C) 1 to 10
(D) -100 to +100

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indicate raw or lower-grade sugar. This standard enables objective quality assessment across international trade markets.

57. (B) ICUMSA scale
The ICUMSA scale is the international standard established by the International Commission for Uniform Methods of Sugar Analysis. It measures the color index and optical purity of sugar solutions using spectrophotometry. Lower numeric ratings correspond to highly refined white sugar, providing a transparent, standardized metric for commercial sugar pricing and quality specification worldwide.

58. (B) I and III only
Free Trade Agreements aim to lower tariff barriers between member states, which can expose local markets to influxes of cheap foreign goods if safeguard measures are lacking. However, FTAs do not eliminate mandatory Sanitary and Phytosanitary safety checks, making statement II false. Thus, statements I and III represent the correct combination.

59. (D) A deficit of ₹20,000 crore
The trade balance is calculated by subtracting total import value from total export value. With exports totaling ₹50,000 crore and imports reaching ₹70,000 crore, the resulting calculation produces a negative balance of ₹20,000 crore. This monetary difference signifies an agricultural trade deficit, indicating greater expenditure on foreign agricultural commodities than export revenue earned.

60. (A) P-3, Q-1, R-2, S-4
Global agricultural trade exhibits regional specialization based on climate and production capacity. Brazil leads global soybean exports, while Indonesia is the top exporter of palm oil. India dominates the worldwide export market for aromatic Basmati rice, and Russia stands as one of the largest global exporters of commercial wheat.

61. (B) Agra
The dedicated Agri Export Zone for potatoes in Uttar Pradesh is centered around the Agra region, a leading potato-producing belt in India. This zone focuses on improving post-harvest management, setting up cold storage infrastructure, promoting processing-grade potato varieties, and facilitating export channels to international markets in neighboring and Middle Eastern countries.

62. (B) Transport subsidy for sugar export
To help sugar mills reduce excess inventory and generate liquidity to pay pending farmer cane dues, the Central Government has periodically provided transport subsidies for sugar exports. Subsidizing internal freight and port handling costs makes Indian sugar exports price-competitive globally, encouraging surplus stock evacuation and easing domestic market supply pressure.

63. (A) Maximum Residue Limit
MRL stands for Maximum Residue Limit. It represents the highest legally permitted concentration of chemical pesticide residues allowed in or on food commodities and animal feed. Established by regulatory agencies like Codex Alimentarius and national food authorities, MRLs ensure food safety, protect public health, and serve as mandatory technical standards in trade.

64. (C) Preventing unauthorized use of regional product names
Geographical Indication tags assist in trade promotion by legally protecting registered product names against unauthorized commercial use or fraudulent imitation. By establishing legal exclusivity based on geographic origin and traditional production methods, GI tags preserve product authenticity, build consumer trust globally, and allow regional producers to capture premium international market value.

65. (B) II and III only
Vegetable oils account for the largest share of India's agricultural import bill, and the government regularly adjusts import tariffs to manage domestic consumer prices and protect local crushers. Statement I is false because India routinely imports pulses to meet internal deficits, making statements II and III the correct combination.

66. (C) USA
The United States of America consistently ranks among the top two agricultural exporters worldwide in total value. Benefiting from extensive arable land, advanced mechanization, robust supply chain infrastructure, and high agricultural productivity, the USA exports vast

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dairy, and meat rapidly from rural farming belts to distant high-demand urban consumer centers and processing hubs.

28. (A) P-3, Q-4, R-1, S-2
Under Uttar Pradesh's One District One Product scheme, specific districts are paired with distinct agricultural specialties. Siddharthnagar is recognized for aromatic Kala Namak rice, while Pratapgarh is celebrated for Aonla processing. Hathras is historically famous for processing and packaging Asafoetida (Hing), and Gonda specializes in pulse processing, promoting regional agrarian industrial development.

29. (B) To assist in air-transporting farm goods to national and global markets
The Krishi Udan scheme was launched to facilitate the air transportation of agricultural products, particularly perishable items like fruits, vegetables, and flowers. By integrating air cargo infrastructure with rural production hubs, especially in northeastern, hilly, and tribal regions, the scheme improves supply chain speed, reduces post-harvest losses, and connects farmers to distant regional and international markets.

30. (A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
Sugarcane is not traded globally in its harvested raw form because sucrose content degrades rapidly within hours of cutting due to inversion. Furthermore, raw cane is bulky and heavy relative to its economic value, making long-distance freight economically non-viable. Processing sugarcane locally into refined sugar or ethanol resolves these spoilage and transport limitations.

31. (A) Domestic farmers face severe price competition and revenue losses
Allowing subsidized foreign farm commodities into domestic markets at zero import duty under a trade agreement depresses domestic market prices. Foreign produce benefiting from home subsidies can undercut locally grown crops. Consequently, domestic farmers face intense price competition, reduced market share, falling crop prices, and significant income losses unless adequate protective measures are implemented.

32. (C) Sulphur dioxide
Exporting high-grade jaggery to premium international markets requires strict control over chemical additives, especially sulphur dioxide. Used as a bleaching agent during sugarcane juice clarification, excessive sulphur residue poses health risks and violates stringent global food safety standards. Premium import markets enforce near-zero tolerance limits for residual chemical bleaches in natural sweeteners.

33. (D) Siddharthnagar
Kala Namak rice, a traditional aromatic paddy variety known for its distinct black husk and nutritional qualities, is featured under the One District One Product scheme for Siddharthnagar district in Uttar Pradesh. Strategic promotion, branding, and export assistance focus on reviving this heritage grain, establishing global market links, and boosting agricultural returns for regional farmers.

34. (C) Pigeon pea (Tur)
Pigeon pea, locally known as Tur or Arhar, represents a major portion of India's pulse imports. Despite extensive domestic cultivation, structural demand for this essential staple consistently exceeds local production. To prevent domestic shortages, curb price inflation, and maintain strategic buffer stocks, India regularly imports substantial volumes of pigeon pea from African and Asian partner nations.

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35. (B) P-2, Q-1, R-4, S-3
Quality certification frameworks address distinct aspects of food trade. AGMARK certifies quality standards and grading for raw agricultural commodities, while FSSAI regulates general food safety standards in India. ISO 22000 specifies international requirements for food safety management systems, and the India Organic mark certifies compliance with national organic export standards.

36. (D) Minimum Selling Price
In the context of domestic sugar mill sales in India, MSP stands for Minimum Selling Price. Established by the Central Government, it sets the mandatory price floor below which sugar mills cannot sell refined sugar in the open market. This policy ensures mills generate sufficient revenue to clear sugarcane arrears owed to farmers.

37. (A) Human, animal, or plant health from international trade risks
The Sanitary and Phytosanitary Agreement under the World Trade Organization establishes

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domestic agriculture with global value chains, and promote high-value processed and organic farm exports. Disincentivizing trade through excessive taxation reduces export competitiveness and hurts farm incomes.

77. (A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
The One District One Product initiative has elevated the export potential of processed food products from Uttar Pradesh by developing district-specific agricultural clusters. By providing technical support for quality control, modern packaging, and geographical branding, the policy addresses long-standing export bottlenecks, directly explaining the improved market competitiveness and growing international trade reach of regional products.

78. (B) Subsidies tied to production-limiting programs
Under the WTO Agreement on Agriculture, the Blue Box encompasses domestic support subsidies that are directly tied to production-limiting programs. It represents a modified form of Amber Box support that is exempt from reduction commitments, provided the payments are based on fixed acreage, set yield levels, or a limited number of livestock head.

79. (A) Abrupt changes in trade policies and sudden export bans
Frequent policy shifts and sudden export bans present significant administrative and market risks for agricultural exporters. Unannounced restrictions imposed to manage domestic inflation disrupt contractual commitments with international buyers. This volatility damages the reliability of domestic suppliers, leads to financial penalties, causes inventory losses, and diminishes long-term market presence in competitive global trade arenas.

80. (C) Milk of lime and Sulphur dioxide gas
Modern sugar processing mills utilize sulfitation to clarify raw sugarcane juice. Milk of lime is added to neutralize natural organic acids and precipitate insoluble impurities, while sulphur dioxide gas is bubbled through the mixture to bleach colored compounds and stabilize pH levels. This chemical treatment ensures effective clarification, producing clear juice suitable for crystallization.

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9. (B) Second largest producer and largest consumer
India holds a commanding position in the global sugar sector as the world's largest consumer and second largest producer after Brazil. Extensive sugarcane cultivation and massive domestic processing capacity satisfy immense internal demand driven by a vast population. Surplus production beyond domestic consumption requirements allows India to export substantial quantities to the global sugar market.

10. (A) P-2, Q-1, R-4, S-3
Institutional frameworks fulfill distinct roles within trade systems. APEDA promotes agricultural and processed food exports from India, while the WTO establishes binding rules for international trade. NCDEX serves as an online platform for trading agricultural commodity futures, and the ODOP initiative focuses on regional product branding to boost localized economic development and export capabilities.

11. (D) Codex Alimentarius Commission
The Codex Alimentarius Commission is recognized under the WTO Sanitary and Phytosanitary Agreement as the international authority for food safety standards. Established jointly by the Food and Agriculture Organization and World Health Organization, it develops harmonized international food guidelines, codes of practice, and maximum residue limits to protect consumer health and ensure fair trade practices.

12. (A) A tariff on imports priced below fair value to protect domestic producers
An anti-dumping duty is a protectionist trade tariff imposed by a government on foreign imports priced below their fair market value or domestic cost. Foreign exporters practice dumping to gain market share, causing material injury to domestic industries. Imposing this customs duty neutralizes the price distortion, restoring fair market competition for local producers.

13. (B) When the value of agricultural exports exceeds that of imports
A nation achieves a positive agricultural trade balance, or trade surplus, when the total monetary value of its exported agricultural products exceeds the total value of imported agricultural goods over a given period. This situation indicates strong domestic production capabilities, high international market competitiveness, and a net inflow of foreign currency into the domestic economy.

14. (B) NCDEX
The National Commodity & Derivatives Exchange is India's leading online commodity exchange specializing in agricultural derivatives. It provides a standardized marketplace for trading futures contracts across various agricultural commodities like pulses, spices, oilseeds, and grains. The exchange facilitates advance price discovery, market transparency, and risk hedging for farmers, traders, processors, and institutional participants.

15. (B) I and II only
The One District One Product scheme in Uttar Pradesh aims to enhance localized production, traditional crafts, and specialized food items. It actively includes agricultural goods to boost rural employment and export potential. Under this scheme, jaggery is designated as the primary product for Ayodhya and Muzaffarnagar, whereas statement III is incorrect because agriculture is included.

16. (C) Phytosanitary Certificate
A Phytosanitary Certificate is an official document issued by authorized plant protection agencies confirming that a consignment of plants, seeds, or plant products meets specified import standards. It certifies that the traded agricultural produce has been officially inspected, treated, and found free from quarantine pests, regulated plant diseases, and harmful organisms prior to export.

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17. (D) APEDA
The Agricultural and Processed Food Products Export Development Authority serves as the designated secretariat for the National Programme for Organic Production in India. Operating under the Ministry of Commerce and Industry, it manages the implementation of organic certification standards, accredits inspection agencies, and promotes the international recognition and trade of Indian certified organic agricultural products.

18. (B) Around 2 to 3%
India accounts for approximately two to three percent of global agricultural exports. Despite being a leading world producer of crops like rice,

10. Which statistical tool is primarily used to predict the value of a dependent variable (like sugarcane yield) based on the known value of an independent variable (like irrigation frequency)?
(A) Regression Analysis
(B) Standard Deviation
(C) Coefficient of Variation
(D) Correlation Analysis

11. Which organization is responsible for recommending the Minimum Support Price (MSP) for mandated crops to the Government of India?
(A) Food Corporation of India (FCI)
(B) National Institution for Transforming India (NITI Aayog)
(C) National Sample Survey Office (NSSO)
(D) Commission for Agricultural Costs and Prices (CACP)

12. Match the cost concepts in List I with their correct definitions in List II:
List I: (Cost Concepts)
P. Cost A2
Q. Cost A2+FL
R. Cost C2
S. Cost C1
List II: (Definitions)
1. Cost A2 + Imputed value of family labour
2. Actual paid-out costs for seeds, fertilizers, hired labour, etc.
3. Cost A2 + Imputed value of family labour + Interest on value of owned capital assets
4. Comprehensive cost including A2+FL + rental value of owned land + interest on fixed capital
(A) P-1, Q-2, R-3, S-4
(B) P-2, Q-1, R-4, S-3
(C) P-4, Q-3, R-2, S-1
(D) P-2, Q-4, R-1, S-3

13. According to the stated government policy aimed at farmer income security, the Minimum Support Price (MSP) is fixed at a minimum of how many times the Cost A2+FL?
(A) 1.25 times
(B) 1.50 times
(C) 2.00 times
(D) 2.50 times

14. At what stage of the crop cycle is the Minimum Support Price (MSP) generally announced by the Government of India?
(A) At the time of harvest
(B) During the mid-growth vegetative stage
(C) After procurement operations are completed
(D) Before the sowing season

15. When recommending the Minimum Support Price (MSP), the CACP considers several factors. Which of the following is NOT one of those considered factors?
(A) Individual farmer's personal loan status
(B) Comprehensive cost of production across regions
(C) Inter-crop price parity and market trends
(D) Overall demand and supply situation in markets

16. What is the fundamental difference between the MSP of foodgrains and the Fair and Remunerative Price (FRP) of sugarcane?
(A) MSP is legally binding on all private buyers, whereas FRP applies strictly to government procurement centers
(B) FRP is mandatory for sugar mills, while MSP acts as a floor price for public procurement
(C) FRP is determined independently by state governments, whereas MSP is fixed directly by individual sugar mills
(D) There is no fundamental legal or operational difference between the two terms as both are identical policies

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17. The Fair and Remunerative Price (FRP) of sugarcane is fixed under the provisions of which statutory order?
(A) Essential Commodities Act, 1955
(B) Sugarcane (Control) Order, 1966
(C) Agricultural Produce Market Committee Act
(D) Food Safety and Standards Act, 2006

18. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): The State Advised Price (SAP) for sugarcane in Uttar Pradesh is generally higher than the Fair and Remunerative Price (FRP) announced by the Central Government.
Reason (R): State governments announce SAP to protect the interests of local sugarcane farmers by taking into account specific regional costs of cultivation and to ensure a higher profit margin.
Which of the following options is correct?
(A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).

to the start of the crushing season
(D) Unilaterally by the Food Corporation of India in consultation with central agencies

70. A statistical regression line derived from historical data shows that every 10 mm increase in rainfall during the vegetative stage increases sugarcane yield by 0.5 tonnes per hectare. This is an example of using statistics for:
(A) Retrospective taxation
(B) Estimating post-harvest storage loss
(C) Calculating the FRP base recovery
(D) Yield prediction and modeling

71. If an agriculture supervisor records the yield of 5 randomly selected sugarcane plots (in tonnes/ha) as 70, 75, 80, 85, and 90, what is the arithmetic mean yield?
(A) 75 tonnes/ha
(B) 80 tonnes/ha
(C) 82.5 tonnes/ha
(D) 85 tonnes/ha

72. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): The e-NAM platform improves price transparency for agricultural commodities.
Reason (R): It integrates physical mandis electronically, allowing buyers from across the country to participate in transparent online bidding for the farmer's produce.
Which of the following options is correct?
(A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).
(B) Both Assertion (A) and Reason (R) are true but Reason (R) is not the correct explanation of Assertion (A).
(C) Assertion (A) is true but Reason (R) is false.
(D) Assertion (A) is false but Reason (R) is true.

73. Which of the following crop types relies on the "Statutory Minimum Price" or "Fair and Remunerative Price" framework rather than standard MSP?
(A) Cotton
(B) Paddy
(C) Sugarcane
(D) Groundnut

74. Which key parameter is increasingly incorporated into modern digital data management systems like the State Cane Portals to ensure equitable supply allocation?
(A) Total number of dependent children living in the farmer's household
(B) Precise distance from the farmer's primary agricultural field to the nearest public hospital
(C) The political affiliation and voting record of the local cane cooperative society chairman
(D) Basic quota based on supply history and surveyed area

75. The Uttar Pradesh Council of Sugarcane Research (UPCSR), which provides vital data and statistics for cane development in the state, is headquartered at:
(A) Lucknow
(B) Shahjahanpur
(C) Kanpur
(D) Meerut

76. Consider the following statements regarding the sugarcane economy and data in Uttar Pradesh:
I. Uttar Pradesh is one of the largest producers of sugarcane in India.
II. The cane area is mapped digitally using GPS and satellite imagery by the Cane Department.
III. The FRP is paid by the central government directly to the UP farmers.
IV. SAP is applicable to all operational sugar mills in Uttar Pradesh.
Which of the above statements is/are correct?
(A) I, II, and III only
(B) II, III, and IV only
(C) I, II, and IV only
(D) I, III, and IV only

77. A district has recorded extreme variations in crop yields due to localized hail storms, with a few villages recording near-zero yields and others recording record-high yields. Which measure of central tendency would be least distorted by these extreme values?
(A) Arithmetic Mean
(B) Geometric Mean
(C) Range
(D) Median

78. Which of the following is the correct sequence of steps involved in processing primary agricultural statistics data?
(A) Data Analysis → Data Collection → Data Presentation → Conclusion Formulation

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(A) Farmers and Scientific Agricultural Logistics
(B) Field Assessment of Sugarcane and Agricultural Lands
(C) Financial Assistance for Statistical Agriculture and Livestock
(D) Forecasting Agricultural output using Space, Agro-meteorology and Land based observations

28. Which of the following best describes the use of Geographic Information System (GIS) technology in compiling agricultural statistics?
(A) Mapping and analyzing spatial data on crop acreage and yields
(B) Monitoring and controlling the moisture content in bulk grain storage silos
(C) Determining and setting up the statutory minimum wages for seasonal farm labour
(D) Calculating and verifying the chemical composition of synthetic fertilizers

29. The Mahalanobis National Crop Forecast Centre (MNCFC) is primarily involved in which of the following activities?
(A) Deciding the annual FRP of sugarcane for processing mills
(B) Directing quality seeds and fertilizers at subsidized market rates
(C) Providing crop estimates via space technology
(D) Procuring surplus wheat and paddy directly from small farmers

30. Which of the following represents the correct sequence of stages in the systematic determination and declaration of the Minimum Support Price (MSP)?
(A) Cabinet approval → CACP consultations with states → Public announcement → Data collection by CACP
(B) Data collection by CACP → Consultations with states and stakeholders → CACP submits recommendations → CCEA approves and announces MSP
(C) Public announcement → CCEA approval → CACP recommendations → State government input
(D) State government input → Public announcement → CCEA approval → CACP recommendation

31. What is the role of the National Sample Survey Office (NSSO), now merged into NSO, in the context of agricultural statistics?
(A) It legally enforces regulatory provisions under the Sugarcane Control Order
(B) It conducts socio-economic and agricultural household sample surveys
(C) It directly distributes the fair and remunerative price to all local sugarcane farmers
(D) It constructs, manages, and maintains massive modern storage silos for the FCI network

32. How does the Minimum Support Price (MSP) policy directly influence farmer income security?
(A) By offering a floor price to prevent distress sales during market gluts
(B) By imposing a strict statutory cap on the maximum income an individual farmer can earn
(C) By forcing small farmers to sell exclusively to private corporate buyers at fixed government rates
(D) By eliminating the financial need for smallholder farmers to purchase commercial synthetic fertilizers

33. The Wholesale Price Index (WPI) is crucial for understanding inflation trends. In the context of agricultural statistics, why is monitoring the agricultural price index important?
(A) It dictates the exact amount of annual rainfall required for crop production across states
(B) It strictly prohibits the international export of any primary agricultural commodity
(C) It assesses terms of trade between agricultural and non-agricultural sectors
(D) It directly determines the physical quality and nutrient composition of regional soil

34. What is the primary function of the e-NAM (National Agriculture Market) platform introduced by the Government of India?
(A) To act as a centralized online portal for purchasing and transferring private agricultural land
(B) To provide accredited online university degrees and diplomas in specialized agricultural sciences
(C) To track and regulate the live movement of migratory agricultural labour across state borders
(D) To create a unified national market for commodities by networking APMC mandis

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35. How does the e-NAM platform contribute to the improvement of price transparency for farmers?
(A) By discovering real-time prices through open electronic bidding
(B) By concealing the prices offered by traders until after the crop is physically delivered
(C) By allowing only government officials to set a uniform price without taking market input
(D) By mandating static standard prices for all commodities regardless of actual crop quality

36. Match the statistical or pricing terms in List I with their corresponding areas of application in List II:
List I: (Terms)
P. FRP
Q. MSP
R. CCE
S. SAP
List II: (Areas of Application)
1. Used for estimating crop yield per hectare
2. Declared by the Central Government for sugarcane
3. Guaranteed minimum price for 22 mandated crops
4. Sugarcane price declared by State Governments like Uttar Pradesh
(A) P-2, Q-3, R-1, S-4
(B) P-3, Q-2, R-4, S-1
(C) P-4, Q-1, R-3, S-2
(D) P-2, Q-4, R-1, S-3

37. Which state government authority in Uttar Pradesh is generally responsible for the regulatory framework regarding cane supply, 'purchi' issuance, and monitoring the state's sugar mills?
(A) Department of Food, Civil Supplies and Public Distribution
(B) Cane Development and Sugar Industry Department
(C) Uttar Pradesh State Seed Certification Agency Corporation
(D) Directorate of Agricultural Statistics and Crop Planning

38. The 'purchi' system in sugarcane supply management refers to:
(A) The official legal land revenue document proving verified individual farmer ownership
(B) The official tax assessment receipt issued for purchasing heavy agricultural equipment
(C) The official certified quality document verifying statutory chemical seed treatment
(D) The supply ticket specifying the date and quantity of cane for mill delivery

39. To address the issue of delays in sugarcane payments, the Sugarcane (Control) Order mandates that sugar mills must pay farmers within how many days of cane delivery, failing which interest is chargeable?
(A) 7 days
(B) 14 days
(C) 30 days
(D) 45 days

40. The 'cane calendar' used by sugar mills and cane societies is essential for:
(A) Scheduling the precise irrigation cycles and fertilizer applications for sugarcane fields
(B) Ensuring systematic supply of mature cane to mills during crushing season
(C) Tracking daily ambient temperature and relative humidity levels for regional pest control
(D) Determining and finalizing scheduled dates for state-wide agricultural union elections

41. The base recovery rate set for determining the FRP of sugarcane primarily reflects:
(A) The relative percentage of unharvested sugarcane stalk left in the field after harvest
(B) The percentage of sugar recovered per 100 kg of crushed cane
(C) The residual moisture content and water density remaining in the harvested sugarcane
(D) The overall transit weight loss of harvested sugarcane during long-distance transport

42. Consider the following statements regarding the FRP determination for sugarcane:
I. It provides a guaranteed price for sugarcane farmers irrespective of the sugar mill's financial health.
II. A higher sugar recovery percentage yields a higher per-quintal FRP for the farmer.
III. The FRP entirely replaces the SAP in states like Uttar Pradesh.
Which of the above statements is/are correct?
(A) I and II only
(B) II and III only
(C) I and III only
(D) I, II, and III

43. Which portal is maintained by the Directorate of Marketing & Inspection (DMI) to collect and

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disseminate daily market prices and arrivals data of agricultural commodities across India?
(A) Kisan Rath
(B) Bhoomi
(C) e-Choupal
(D) Agmarknet

44. Identify the incorrect statement regarding the Agriculture Census in India:
(A) It provides vital data on the structural aspects of operational holdings.
(B) It is conducted annually to track real-time yield fluctuations.
(C) The data is collected phase-wise, detailing land use, cropping patterns, and irrigation status.
(D) It helps policy makers understand the fragmentation of landholdings over time.

45. In agricultural statistics, 'Production' of a crop is calculated by which of the following standard formulas?
(A) Area ÷ Yield
(B) Area × Yield
(C) Yield ÷ Area
(D) Area + Yield

46. If an agronomist states that the variance of sugarcane yield data across a block is zero, it implies that:
(A) No commercial sugarcane crop was produced anywhere within the entire block
(B) The collected yield data distribution is heavily skewed toward lower values
(C) The selected sample size was statistically too small to reliably measure yield
(D) The yield was identical across all fields in the block

47. Which specific agricultural price indices are often used to estimate the real income of farmers by comparing the prices of goods they sell versus the prices of goods they purchase?
(A) Consumer Price Index for Urban Non-Manual Employees
(B) Index of Terms of Trade for Agriculture
(C) Index of Industrial Production for Manufacturing
(D) BSE SENSEX Stock Market Capitalization Index

48. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): Effective implementation of the MSP policy requires massive storage infrastructure like modern silos.
Reason (R): Government agencies must physically procure and safely store large quantities of grains when market prices fall below the declared MSP.
Which of the following options is correct?
(A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).
(B) Both Assertion (A) and Reason (R) are true but Reason (R) is not the correct explanation of Assertion (A).
(C) Assertion (A) is true but Reason (R) is false.
(D) Assertion (A) is false but Reason (R) is true.

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49. In Uttar Pradesh, sugarcane cooperative societies play a pivotal role. What is their primary function in the cane supply mechanism?
(A) To directly manufacture and process refined sugar from harvested raw cane
(B) To liaise between farmers and mills for cane indenting and payment
(C) To market and export raw sugarcane directly to foreign processing countries
(D) To independently fix and determine the SAP without state government approval

50. For calculating sugar recovery percentage, if a sugar mill crushes 10,000 quintals of sugarcane and produces 1,050 quintals of sugar, what is the recovery percentage?
(A) 9.5%
(B) 10.0%
(C) 10.5%
(D) 11.0%

51. The Crop Cutting Experiment (CCE) traditionally uses random sampling. Why is random sampling preferred for yield estimation over purposive selection?
(A) It is significantly faster and far less costly to execute during field trials
(B) It eliminates bias to provide a representative regional estimate
(C) It reliably guarantees that the absolute highest crop yield will be recorded
(D) It allows local revenue officials to freely choose the most accessible plots

52. Which modern digital technology is utilized to permanently and securely record land ownership and agricultural transaction data without the risk of tampering?

(B) Both Assertion (A) and Reason (R) are true but Reason (R) is not the correct explanation of Assertion (A).
(C) Assertion (A) is true but Reason (R) is false.
(D) Assertion (A) is false but Reason (R) is true.

19. Consider the following statements regarding the Fair and Remunerative Price (FRP) mechanism:
I. FRP is announced by the Cabinet Committee on Economic Affairs (CCEA).
II. FRP is linked to a basic sugar recovery percentage.
III. A premium is provided to farmers for every 0.1% increase in recovery above the base level.
Which of the above statements is/are correct?
(A) I and II only
(B) II and III only
(C) I and III only
(D) I, II, and III

20. In the context of sugarcane pricing in India, what happens to the FRP payable to a farmer if the actual sugar recovery of the mill is lower than the stipulated base recovery level?
(A) The farmer receives no payment for the delivered cane until the mill recovers its costs
(B) The FRP is proportionately reduced without any minimum guaranteed lower floor limit
(C) The state government pays the full monetary difference as a direct subsidy to the mill owner
(D) A floor price is paid if recovery exceeds a statutory minimum threshold

21. For the purpose of government procurement under the Minimum Support Price (MSP) system, which agency serves as the nodal central agency for procuring wheat and paddy?
(A) NAFED
(B) Food Corporation of India (FCI)
(C) State Trading Corporation
(D) National Dairy Development Board

22. While FCI is the nodal agency for cereals, which central agency primarily undertakes the procurement of pulses and oilseeds under the Price Support Scheme (PSS)?
(A) NAFED
(B) APEDA
(C) NABARD
(D) Commission for Agricultural Costs and Prices

23. What is the primary relationship between the Public Distribution System (PDS) and the Minimum Support Price (MSP) operations?
(A) PDS shops independently declare and regulate their own seasonal MSP rates for local farmers
(B) PDS exclusively distributes imported foodgrains, completely bypassing the domestic MSP procurement system
(C) Grains procured at MSP are stored and distributed via PDS
(D) MSP operations procure only commercial crops, while PDS relies entirely on open-market cereal purchases

24. Consider the following statements regarding the crops covered under the Minimum Support Price (MSP) regime:
I. The government announces MSP for 22 mandated crops and FRP for sugarcane.
II. The mandated crops include 14 Kharif crops and 6 Rabi crops.
III. Copra and raw jute are included in the commercial crops category under MSP.
IV. Vegetables like potato and onion are permanently covered under the mandatory MSP regime.
Which of the above statements is/are correct?
(A) I, II, and III only
(B) II, III, and IV only
(C) I, III, and IV only
(D) I, II, III, and IV

25. Storage is a critical challenge in the implementation of the MSP policy. What does the term 'CAP storage' refer to in the context of foodgrain storage by FCI?
(A) Central Agricultural Protection storage
(B) Cold and Processed storage
(C) Controlled Atmospheric Pressure storage
(D) Cover and Plinth storage

26. Which modern technology is increasingly utilized by the Government of India for the early forecasting of crop production and acreage estimation before the actual harvest?
(A) Mechanical soil tilling
(B) Remote Sensing through satellites
(C) High-frequency radio broadcasting systems
(D) Deep-sea sonar mapping technology

27. Under the Ministry of Agriculture, the FASAL scheme is operationalized for crop forecasting. What does FASAL stand for?

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61. Out of the total number of operational holdings in India, which category of farmers constitutes the largest percentage according to recent Agriculture Censuses?
(A) Large operational farmers owning over ten hectares
(B) Medium operational farmers owning four to ten hectares
(C) Marginal and small farmers
(D) Semi-medium operational farmers owning two to four hectares

62. Find the odd one out among the following terms used in agricultural statistics:
(A) Standard Deviation
(B) Correlation Coefficient
(C) Variance
(D) Minimum Support Price

63. Match the agricultural agencies/institutions in List I with their core focus areas in List II:
List I: (Agencies/Institutions)
P. NSSO (NSO)
Q. CACP
R. MNCFC
S. FCI
List II: (Core Focus Areas)
1. Recommending MSP/FRP prices
2. Procurement and storage of foodgrains
3. Conducting large-scale socio-economic and agricultural surveys
4. Satellite-based crop forecasting
(A) P-3, Q-1, R-4, S-2
(B) P-1, Q-2, R-3, S-4
(C) P-4, Q-3, R-2, S-1
(D) P-3, Q-4, R-1, S-2

64. What happens if the market price of a mandated crop falls below the declared Minimum Support Price (MSP)?
(A) Farmers must immediately halt all ongoing harvesting operations in fields
(B) Government agencies intervene to procure the crop at MSP
(C) The CACP immediately revises and lowers the declared MSP for that season
(D) The affected crop is legally banned from being commercially traded in mandis

65. The 'Price Support Scheme' (PSS) and 'Price Deficiency Payment Scheme' (PDPS) are key components of which overarching umbrella scheme of the Government of India?
(A) Pradhan Mantri Fasal Bima Yojana (PMFBY) crop insurance initiative
(B) Pradhan Mantri Annadata Aay SanraksHan Abhiyan (PM-AASHA)
(C) Pradhan Mantri Krishi Sinchayee Yojana (PMKSY) irrigation program
(D) National Soil Health Card Scheme for soil nutrient management

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66. Under the Price Deficiency Payment Scheme (PDPS), how is the farmer compensated?
(A) The government physically procures and stores the entire harvested crop directly from farmers
(B) The government pays the difference between MSP and market price into bank accounts
(C) The farmer is compensated with equivalent subsidized weight in chemical and organic fertilizers
(D) The farmer's outstanding agricultural bank loans are written off completely and automatically

67. To ensure reliable agricultural statistics, 'Area Sown' data is primarily compiled by aggregating village-level records maintained by the:
(A) District Magistrate
(B) Chief Medical Officer
(C) Block Development Officer
(D) Patwari / Lekhpal

68. Consider the following statements regarding the use of GPS (Global Positioning System) in agricultural statistics:
I. GPS allows for exact measurement of the field area during surveys.
II. It aids in geo-tagging the locations of Crop Cutting Experiments (CCEs) for transparency.
III. It can independently determine the soil nutrient composition without physical testing.
Which of the above statements is/are correct?
(A) I and II only
(B) II and III only
(C) I and III only
(D) I, II, and III

69. The State Advised Price (SAP) of sugarcane in Uttar Pradesh is typically announced:
(A) Based solely on automated satellite remote sensing data and weather forecasts
(B) By the State Sugarcane Control Board considering local costs and representations
(C) Directly by private sugar mill owners prior

ANSWERS

1. (B) To provide a reliable data foundation for policy, planning, and evaluation
Compiling agricultural statistics serves as a critical foundation for formulation, implementation, and evaluation of agricultural policies and developmental plans. Accurate data on land utilization, crop acreage, yield estimates, and production trends enable policymakers to design targeted interventions, manage food security, allocate budgetary resources effectively, and assess the economic performance of the agricultural sector.

2. (A) Crop Cutting Experiments (CCE)
Crop Cutting Experiments represent the scientifically validated official method for estimating crop yields across districts and states in India. This technique involves selecting random sample plots within designated agricultural fields, harvesting the crop from the specified area, threshing, drying, and weighing the produce to derive objective, statistically sound yield estimates for principal crops.

3. (B) 5 metres x 5 metres
In India, Crop Cutting Experiments follow standardized sampling frameworks to ensure uniformity and statistical precision. For major cereal crops like wheat and paddy, state agricultural and statistical departments typically demarcate a standard plot size of 5 metres by 5 metres within randomly selected fields to harvest, dry, and weigh the grain yield accurately.

4. (D) The operational holding
The Agriculture Census in India uses the operational holding as its basic unit of data collection rather than individual ownership or household identity. An operational holding is defined as all land used wholly or partly for agricultural production, managed by one person alone or jointly with others, without regard to title, legal form, size, or location.

5. (A) I and II only
The Agriculture Census classifies operational holdings into five distinct categories based on size. Marginal farmers operate land holdings of less than 1.0 hectare, whereas small farmers manage holdings between 1.0 and 2.0 hectares. Semi-medium farmers operate land holdings ranging from 2.0 to 4.0 hectares, making the statement regarding semi-medium holdings incorrect.

6. (B) Mode
Mode is the statistical measure of central tendency that identifies the most frequently occurring value in a data distribution. When analyzing daily market prices in a mandi, determining the mode reveals the predominant price point at which the largest volume of transaction trades occurred, making it the most suitable metric for frequency-based price evaluation.

7. (D) Median
In highly skewed distribution datasets where extreme values or outliers exist—such as landholding patterns where a few wealthy individuals own extensive acreage while the majority hold very small plots—the median provides the most realistic central value because it divides the ordered data into two equal halves and remains unaffected by extreme positive outliers.

8. (C) Positive
The correlation coefficient measures the direction and strength of a linear relationship between variables. Up to agronomic optimal limits, increasing fertilizer application results in higher crop yield, establishing a direct positive correlation where both agricultural variables move simultaneously in an upward direction under controlled experimental field conditions.

9. (B) -1 to +1
Karl Pearson's coefficient of correlation (r) is a standardized mathematical measure bounded strictly between -1.0 and +1.0. A value of +1 indicates a perfect positive linear relationship, -1 indicates a perfect negative linear relationship, and 0 indicates the total absence of a linear association between variables like rainfall and crop production.

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(B) Data Collection → Data Classification and Tabulation → Data Analysis → Interpretation
(C) Interpretation → Data Tabulation → Data Collection → Data Analysis
(D) Data Collection → Interpretation → Data Tabulation → Data Analysis

79. Match the modern data management systems in List I with their primary utility in agriculture in List II:
List I: (Systems)
P. GIS
Q. e-NAM
R. DBT
S. Remote Sensing
List II: (Primary Utility)
1. Seamless transfer of subsidies or MSP payments directly to farmers
2. Electronic trading and transparent price discovery
3. Spatial mapping of crop acreage and soil health
4. Satellite-based monitoring of crop vigour and weather patterns
(A) P-3, Q-2, R-1, S-4
(B) P-2, Q-3, R-4, S-1
(C) P-4, Q-1, R-2, S-3
(D) P-3, Q-4, R-1, S-2

80. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): The latest Agriculture Censuses in India are increasingly shifting towards digital data collection via tablets and smartphones.
Reason (R): Digital data collection eliminates human error entirely and makes the basic statistical unit an individual person rather than an operational holding.
Which of the following options is correct?
(A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).
(B) Both Assertion (A) and Reason (R) are true but Reason (R) is not the correct explanation of Assertion (A).
(C) Assertion (A) is true but Reason (R) is false.
(D) Assertion (A) is false but Reason (R) is true.

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(A) Virtual Reality
(B) Blockchain Technology
(C) 3D Printing
(D) Basic HTML programming

53. Consider the following statements regarding the procurement system under MSP:
I. Procurement operations are open-ended for wheat and paddy in states with established systems.
II. Farmers are legally bound to sell their produce only to government procurement centres.
III. The procured grains form the central pool buffer stock.
IV. Payment to farmers for MSP procurement is increasingly done via Direct Benefit Transfer (DBT).
Which of the above statements is/are correct?
(A) I, II, and III only
(B) I, III, and IV only
(C) II, III, and IV only
(D) I, II, III, and IV

54. When CACP evaluates the "Terms of Trade" while recommending MSP, it is fundamentally analyzing the ratio between:
(A) The aggregate export volume and total import volume of raw agricultural commodities
(B) The ratio between motorized tractors bought and traditional draught bullocks sold
(C) Historical urban population growth rates compared against rural population trends
(D) Prices received for produce versus prices paid for inputs and consumer goods

55. In the context of yield assessment, the 'Appraisal Method' (or visual estimation by revenue officials) is considered:
(A) Subjective and prone to personal bias
(B) Highly objective and precise
(C) The gold standard for modern agricultural statistics
(D) More reliable than Crop Cutting Experiments (CCE)

56. What is the primary cause of post-harvest storage losses in agricultural commodities under government procurement systems?
(A) High initial MSP declarations leading to excessive market speculation
(B) Inadequate storage facilities exposed to moisture and pests
(C) Excessive over-reliance on unverified satellite imagery for crop monitoring
(D) Repeated administrative delays in executing Direct Benefit Transfer payments

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57. The concept of 'Fair and Remunerative Price' (FRP) replaced the earlier concept of 'Statutory Minimum Price' (SMP) for sugarcane in which year?
(A) 1991
(B) 2000
(C) 2009
(D) 2018

58. Arrange the following steps of crop production forecasting using remote sensing in the correct chronological order:
I. Ground truthing and field validation
II. Acquisition of satellite imagery for the target area
III. Development and application of the crop yield model
IV. Pre-processing and digital classification of the imagery
Which of the following represents the correct sequence?
(A) II, IV, I, III
(B) II, I, IV, III
(C) I, II, IV, III
(D) IV, II, III, I

59. Which digital system is widely implemented by state governments to issue online supply tickets (purchis) to sugarcane farmers via SMS?
(A) AutoCAD Architectural Design and Drafting System
(B) Core Banking Solution (CBS) financial framework
(C) Geographic Information System (GIS) mapping network
(D) ERP-based Cane Management System

60. To address the issue of under-weighment of agricultural produce at mandis or mills, which intervention is most effective at ensuring accurate statistical recording and fair payment?
(A) Digital weighbridges integrated with automated computerized billing
(B) Reverting strictly to traditional mechanical beam balances operated manually
(C) Allowing the commercial buyer to visually estimate the total load weight
(D) Conducting mandatory Crop Cutting Experiments directly at the market yard

10. (A) Regression Analysis
Regression analysis is a statistical estimation tool used to predict or estimate the specific numerical value of a dependent variable based on the known values of one or more independent predictor variables. In agriculture, it models cause-and-effect relationships, such as forecasting sugarcane yield per hectare based on irrigation frequency and application rates.

11. (D) Commission for Agricultural Costs and Prices (CACP)
The Commission for Agricultural Costs and Prices, an attached office of the Ministry of Agriculture and Farmers Welfare, is mandated to submit price recommendations for Minimum Support Prices. It evaluates comprehensive cost of production data, market demand-supply dynamics, inter-crop price parity, terms of trade, and consumer implications before finalizing statutory price proposals.

12. (B) P-2, Q-1, R-4, S-3
Cost A2 represents paid-out direct costs incurred in crop cultivation including seeds, fertilizers, pesticides, hired labor, and fuel. Adding the imputed financial value of unpaid family labor yields Cost A2+FL. Cost C1 includes Cost A1/ A2 plus interest on owned fixed capital assets, whereas Cost C2 covers Cost C1 plus the rental value of owned land.

13. (B) 1.50 times
In alignment with the Union Budget policy announcement, Minimum Support Prices are determined to ensure a guaranteed return of at least 50 percent over the cost of production. Consequently, MSP recommendations are calculated at a minimum benchmark of 1.50 times (or 150 percent of) the Cost A2+FL, which encompasses actual expenses plus family labor.

14. (D) Before the sowing season
Minimum Support Prices are officially announced by the Government of India prior to the commencement of the sowing season for both Kharif and Rabi crop cycles. Announcing support prices in advance provides price certainty, enabling farmers to make informed acreage allocation decisions and plan investments in agricultural inputs ahead of cultivation.

15. (A) Individual farmer's personal loan status
When recommending Minimum Support Prices, the Commission for Agricultural Costs and Prices evaluates macro and microeconomic parameters, including production costs, market supply and demand trends, inter-crop price parity, changes in input prices, and terms of trade. Personal financial liabilities or individual loan accounts of individual farmers are not part of the price formulation framework.

16. (B) FRP is mandatory for sugar mills, while MSP acts as a floor price for public procurement
The Fair and Remunerative Price for sugarcane is a statutory price fixed by the Central Government under the Sugarcane (Control) Order, making it legally binding on private and cooperative sugar mills to pay cane growers. In contrast, MSP acts as a benchmark floor price at which government procurement agencies buy grain from markets.

17. (B) Sugarcane (Control) Order, 1966
The Fair and Remunerative Price of sugarcane is fixed statutorily under Clause 3 of the Sugarcane (Control) Order, 1966, issued under the powers conferred by Section 3 of the Essential Commodities Act, 1955. This legal enactment empowers the Central Government to determine uniform minimum cane purchase prices payable by processing mills across India.

18. (A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).
State governments like Uttar Pradesh fix State Advised Prices for sugarcane above the central Fair and Remunerative Price to account for regional variations in cost of production, transportation, and local economic conditions. The objective of SAP is to guarantee higher remuneration to state sugarcane farmers, directly explaining why SAP typically exceeds central FRP.

19. (D) I, II, and III
The Cabinet Committee on Economic Affairs approves the Fair and Remunerative Price for sugarcane based on CACP recommendations. FRP is structurally linked to a benchmark sugar recovery rate. A monetary premium is statutorily payable to cane farmers for every 0.1 percent increase in recovery achieved above that specified base level.

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image classification are performed. Third, ground truthing and field validation are conducted to verify land signatures. Finally, validated data is integrated into agronomic yield models to estimate production.

59. (D) ERP-based Cane Management System
State governments in sugarcane-producing regions deploy Enterprise Resource Planning based Cane Management Systems to digitize cane supply chains. These automated digital platforms manage farmer registration, survey plot mapping, cane calendar calculations, and automated SMS issuance of supply tickets (purchis), eliminating manual intervention and enhancing transparency in mill cane supply scheduling.

60. (A) Digital weighbridges integrated with automated computerized billing
Implementing digital electronic weighbridges integrated with automated computerized billing systems eliminates human tampering and weighment manipulation at agricultural mandis and sugar mill reception gates. Automated systems capture gross and tare weights accurately, print tamper-proof weight slips instantly, and digitally record transactions to guarantee accurate statistical documentation and correct producer payments.

61. (C) Marginal and small farmers
Data from the Agriculture Census reveals that marginal farmers (operating under 1.0 hectare) and small farmers (operating between 1.0 and 2.0 hectares) collectively constitute the vast majority of operational holdings in India, accounting for over 86 percent of all farm holdings due to continuous land fragmentation across successive generations.

62. (D) Minimum Support Price
Standard Deviation, Correlation Coefficient, and Variance are core mathematical metrics used in descriptive and inferential statistics to calculate variability, dispersion, and relationships within data distributions. In contrast, Minimum Support Price is an agricultural economics policy instrument established by the government to support crop prices rather than a statistical measurement technique.

63. (A) P-3, Q-1, R-4, S-2
The National Sample Survey Office conducts comprehensive socio-economic and agricultural household surveys. The Commission for Agricultural Costs and Prices recommends MSP and FRP price benchmarks. The Mahalanobis National Crop Forecast Centre handles satellite-based remote sensing crop estimates. The Food Corporation of India manages nationwide public foodgrain procurement and storage operations.

64. (B) Government agencies intervene to procure the crop at MSP
When open-market prices of mandated agricultural crops fall below declared Minimum Support Prices due to surplus market supply, designated central and state procurement agencies execute price support operations. Procurement entities step in to buy grain directly from farmers at declared MSP rates, stabilizing market prices and protecting agricultural producers from financial loss.

65. (B) Pradhan Mantri Annadata Aay SanraksHan Abhiyan (PM-AASHA)
PM-AASHA is an overarching umbrella scheme launched by the Central Government to ensure remunerative prices for farmers. It comprises three sub-schemes: the Price Support Scheme for physical procurement of pulses, oilseeds, and copra; the Price Deficiency Payment Scheme covering oilseeds; and the Private Procurement and Stockist Scheme piloted in select districts.

66. (B) The government pays the difference between MSP and market price into bank accounts
Under the Price Deficiency Payment Scheme, no physical procurement of produce occurs. Instead, registered farmers sell their oilseeds in notified mandis at prevailing market rates. If the modal market sale price is lower than the MSP, the government directly transfers the price difference into the farmer's bank account via Direct Benefit Transfer.

67. (D) Patwari / Lekhpal
In India's land record and agricultural statistics framework, the primary field official responsible for recording crop statistics is the village revenue accountant, known as Patwari or Lekhpal. The Patwari conducts periodic field inspections (girdawari) to record field-by-field crop area sown, irrigation source, and land utilization data at the revenue village level.

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meteorological statistical models to generate accurate pre-harvest production estimates and acreage assessments for key agricultural crops.

30. (B) Data collection by CACP → Consultations with states and stakeholders → CACP submits recommendations → CCEA approves and announces MSP
Determining Minimum Support Prices follows a multi-stage process. First, CACP compiles comprehensive cost and market data. Next, it conducts consultations with state governments, farmer associations, and ministries. CACP then submits formal recommendation reports. Finally, the Cabinet Committee on Economic Affairs reviews and approves the proposals, after which MSPs are publicly announced.

31. (B) It conducts socio-economic and agricultural household sample surveys
The National Sample Survey Office, operating within the National Statistical Office under the Ministry of Statistics and Programme Implementation, conducts extensive nationwide sample surveys. In agriculture, it collects essential socio-economic data on farming households, landholdings, household indebtedness, livestock ownership, cost of cultivation inputs, and rural employment conditions across all Indian states.

32. (A) By offering a floor price to prevent distress sales during market gluts
Minimum Support Price policy protects farmer income security by establishing a guaranteed price floor for agricultural commodities. During harvest periods when market gluts cause market prices to plunge, government agencies step in to buy produce at MSP, preventing distress selling below production costs and ensuring basic financial protection for farmers.

33. (C) It assesses terms of trade between agricultural and non-agricultural sectors
Monitoring agricultural price indices provides vital analytical insights into the economic health of rural markets. Specifically, tracking price movements of agricultural outputs relative to manufactured goods and inputs allows economists to evaluate the terms of trade between agricultural and non-agricultural sectors, assessing changes in real purchasing power of rural agricultural producers.

34. (D) To create a unified national market for commodities by networking APMC mandis
The e-NAM platform is a pan-India electronic trading portal launched to network existing Agricultural Produce Market Committee mandis into a unified online market. By connecting diverse agricultural market yards digitally, e-NAM facilitates pan-India trade in agricultural commodities, streamlines market transactions, reduces price dispersion, and provides farmers access to wider buyer bases.

35. (A) By discovering real-time prices through open electronic bidding
The e-NAM platform enhances price transparency by replacing closed or opaque physical bidding with an open online electronic auction system. Real-time price discovery takes place as registered traders from across the country submit competitive bids electronically, allowing farmers to view live competitive prices before accepting offers for their agricultural commodities.

36. (A) P-2, Q-3, R-1, S-4
Fair and Remunerative Price is declared by the Central Government specifically for sugarcane. Minimum Support Price provides a guaranteed floor price for 22 mandated agricultural crops. Crop Cutting Experiments are field techniques utilized to estimate crop yields per hectare. State Advised Price is declared by state governments like Uttar Pradesh for sugarcane.

37. (B) Cane Development and Sugar Industry Department
In Uttar Pradesh, the Cane Development and Sugar Industry Department is the regulatory authority overseeing the entire sugarcane sector. Headed by the Cane Commissioner, it administers cane supply management, oversees cooperative cane societies, issues supply slips (purchis), monitors sugar mill crushing operations, and ensures timely payment of sugarcane prices to state farmers.

38. (D) The supply ticket specifying the date and quantity of cane for mill delivery
A purchi is an official supply ticket issued to registered sugarcane farmers detailing the scheduled date, delivery center, and quantity of sugarcane to be harvested and delivered to sugar mills. This structured allotment system regulates daily cane arrivals at sugar mills, preventing

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AGMARK certification, was passed in which year?
(A) 1937
(B) 1955
(C) 1972
(D) 1986

9. Given below are two statements, one labelled as Assertion (A) and the other as Reason (R).
Assertion (A): The Minimum Support Price (MSP) acts as a floor price for major agricultural commodities in India.
Reason (R): If the open market price falls below the MSP, government agencies procure the standard quality produce at the MSP to protect farmers from distress sales.
Select the correct answer using the options given below:
(A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
(B) Both Assertion (A) and Reason (R) are true but R is not the correct explanation of A.
(C) Assertion (A) is true but Reason (R) is false.
(D) Assertion (A) is false but Reason (R) is true.

10. The Government of India initiated a scheme to develop and upgrade existing rural periodic markets into GrAMs. What does GrAM stand for?
(A) Gramin Agricultural Markets
(B) Gross Agricultural Margins
(C) Graded Agricultural Mandis
(D) Gramin Agribusiness Models

11. The price of sugarcane legally bound to be paid by sugar mills to farmers in Uttar Pradesh is declared by the State Government. This price is known as:
(A) Fair and Remunerative Price (FRP)
(B) State Advised Price (SAP)
(C) Minimum Support Price (MSP)
(D) Statutory Minimum Price (SMP)

12. Arrange the typical institutional sugarcane marketing channel in Uttar Pradesh in the correct sequential order from origin to final processing:
I. Sugar Mill
II. Sugarcane Farmer
III. Cane Cooperative Society
(A) II, I, III
(B) II, III, I
(C) III, II, I
(D) I, III, II

13. Which of the following statements regarding intermediaries in agricultural marketing is incorrect?
(A) A long intermediary chain always yields higher returns for the primary producer.
(B) Intermediaries perform vital functions in bridging the logistical gap between producers and ultimate consumers.
(C) Commission agents facilitate trade transactions without acquiring legal ownership of physical produce.
(D) Middlemen provide key marketing services including grading, primary packaging, storage, and trade financing.

14. Which of the following is an essential component of a cold-chain marketing infrastructure used for highly perishable horticultural crops?
(A) Threshing floor
(B) Grain silo
(C) Pre-cooling unit
(D) Combine harvester

15. Consider the following statements regarding the e-NAM scheme:
I. It provides a single window service for all APMC related information and services.
II. It completely abolishes the existence of physical APMC mandis.
III. It facilitates pan-India trade in agriculture commodities through a unified electronic portal.
IV. State governments need to amend their APMC Acts to provide a unified trading license to integrate with e-NAM.
Which of the above statement(s) is/are correct?
(A) I, II, and III
(B) I, III, and IV
(C) II, III, and IV
(D) I, II, III, and IV

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16. Which organization is responsible for recommending the Fair and Remunerative Price (FRP) of sugarcane to the Government of India?
(A) Indian Institute of Sugarcane Research (IISR)
(B) Small Farmers Agribusiness Consortium (SFAC)
(C) Commission for Agricultural Costs and Prices (CACP)
(D) National Bank for Agriculture and Rural Development (NABARD)

handle, and hold massive quantities of foodgrains during gluts to support prices, modern storage infrastructure like silos is essential to prevent grain spoilage.

49. (B) To liaise between farmers and mills for cane indenting and payment
Sugarcane cooperative societies in Uttar Pradesh serve as intermediary institutional bridges between individual cane growers and sugar mills. They aggregate local farmer data, perform field surveys, issue supply slips (purchis) according to canonical calendars, facilitate orderly mill deliveries, and manage financial transactions ensuring timely disbursement of cane payments to member farmers.

50. (C) 10.5%
Sugar recovery percentage is calculated by dividing total sugar produced by total sugarcane crushed and multiplying by 100 [(Sugar Produced ÷ Sugarcane Crushed) × 100]. Substituting the given values [(1,050 quintals ÷ 10,000 quintals) × 100] yields 0.105 × 100 = 10.5 percent sugar recovery rate for the processed cane lot.

51. (B) It eliminates bias to provide a representative regional estimate
Random sampling in Crop Cutting Experiments ensures that every agricultural plot within a sampling frame has a known, non-zero probability of selection. By eliminating human subjective bias inherent in visual or purposive selection, random sampling produces statistically unbiased, representative yield estimates that can be reliably generalized across entire districts and states.

52. (B) Blockchain Technology
Blockchain technology operates as a decentralized, immutable digital ledger system where recorded data transactions are cryptographically linked across network nodes. In agriculture, blockchain enables secure land record management, transparent supply chain tracking, and tamper-proof transaction records that cannot be altered retroactively without network consensus, ensuring overall digital data integrity.

53. (B) I, III, and IV only
Under MSP procurement, government buying of wheat and paddy is open-ended, meaning agencies procure all grain meeting quality standards. Farmers are free to sell in open markets or to government procurement centers. Procured grains form central pool buffer stocks, and payments are directly deposited into farmer bank accounts via Direct Benefit Transfer.

54. (D) Prices received for produce versus prices paid for inputs and consumer goods
Terms of trade in agricultural pricing evaluates economic parity by measuring the index ratio of prices received by farmers for agricultural output relative to prices paid for agricultural inputs, consumer goods, and farm services. This analytical evaluation ensures MSP recommendations account for changes in farming input expenses and rural inflation.

55. (A) Subjective and prone to personal bias
The appraisal method involves visual estimation of crop yields conducted by local revenue officials based on eye observation. Because eye-estimation relies heavily on personal judgment, experience, and individual perception without empirical physical measurement, it is considered inherently subjective, inconsistent, and highly vulnerable to personal bias compared to standardized crop cutting experiments.

56. (B) Inadequate storage facilities exposed to moisture and pests
Post-harvest storage losses during public procurement primarily stem from deficiencies in physical storage infrastructure, such as open-air Cover and Plinth facilities. Exposure to high moisture, rainfall, fungal infestation, insects, rodents, and inadequate aeration leads to qualitative degradation and quantitative loss of stored foodgrains prior to final public distribution.

57. (C) 2009
The system of Statutory Minimum Price for sugarcane was replaced by Fair and Remunerative Price following an amendment to the Sugarcane (Control) Order, 1966, enacted in October 2009. Introduced for the 2009-10 sugar season, FRP established a uniform, benchmark recovery-linked statutory pricing framework to ensure guaranteed returns for cane growers.

58. (A) II, IV, I, III
Crop forecasting using remote sensing follows a sequential analytical workflow. First, satellite imagery covering the target geographic area is acquired. Second, digital pre-processing and

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78. (B) Data Collection → Data Classification and Tabulation → Data Analysis → Interpretation
Processing primary statistical data follows a mandatory logical progression. First, primary data is collected from field surveys. Second, collected raw data is systematically classified and structured into tables. Third, statistical analytical tools are applied to calculate descriptive metrics. Finally, results are interpreted to formulate policy conclusions and draw empirical findings.

79. (A) P-3, Q-2, R-1, S-4
Geographic Information Systems enable spatial mapping of crop acreage and land parameters. e-NAM functions as an electronic platform for national transparent commodity trading. Direct Benefit Transfer facilitates direct monetary subsidy transfers into verified farmer bank accounts. Remote Sensing uses satellite observations to monitor crop growth patterns, acreage, and weather events.

80. (C) Assertion (A) is true but Reason (R) is false.
The Agriculture Census in India increasingly utilizes digital data collection through smartphones and tablets to accelerate data compilation and reduce transmission delays. However, digital collection does not eliminate human reporting errors entirely, and the basic statistical unit of the Agriculture Census remains the operational holding, not an individual farm person.

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68. (A) I and II only
Global Positioning System technology accurately records spatial geographic coordinates to precisely measure field plot boundaries and land area during surveys. Geo-tagging CCE locations using GPS ensures transparency and spatial verification. However, GPS measures spatial location coordinates only and cannot perform chemical analysis to determine soil nutrient composition without laboratory soil tests.

69. (B) By the State Sugarcane Control Board considering local costs and representations
The State Advised Price for sugarcane in Uttar Pradesh is determined by the state government through the State Sugarcane Control Board. The board evaluates regional costs of cultivation, conversion costs incurred by processing mills, sugar prices, and representations submitted by cane growers' cooperatives and sugar mill associations before recommending the final SAP.

70. (D) Yield prediction and modeling
Deriving a mathematical relationship between rainfall and crop yield using a regression equation illustrates the application of statistical modeling for crop yield prediction. By quantifying how changes in independent environmental variables impact dependent yield outcomes, statisticians can build predictive agronomic models to estimate sugarcane production under varying local weather conditions.

71. (B) 80 tonnes/ha
The arithmetic mean is calculated by summing all observed numerical values in a dataset and dividing the sum by the total number of observations. Adding the five sugarcane yields gives $70 + 75 + 80 + 85 + 90 = 400$. Dividing 400 by 5 yields an arithmetic mean yield of 80 tonnes per hectare.

72. (A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).
The e-NAM platform directly improves price transparency by creating a networked online trading network across agricultural produce mandis. By enabling buyers nationwide to participate in real-time competitive electronic bidding, it removes local buyer monopolies and visual price suppression, providing transparent market pricing that explains the overall improvement in price discovery.

73. (C) Sugarcane
Unlike major foodgrains and oilseeds which are governed under the general Minimum Support Price administration, sugarcane operates specifically under a statutory pricing framework. Sugarcane pricing is governed at the central level by the Fair and Remunerative Price and at the state level by the State Advised Price under the Sugarcane (Control) Order.

74. (D) Basic quota based on supply history and surveyed area
Modern digital cane management systems calculate supply slip allocations using structured mathematical rules based on verified field survey data. Basic supply quotas are determined using measured sugarcane land acreage and historic cane delivery records of the grower, ensuring equitable, objective ticket allocation across all registered farmers while preventing quota misallocation.

75. (B) Shahjahanpur
The Uttar Pradesh Council of Sugarcane Research is headquartered at Shahjahanpur, Uttar Pradesh. Established to advance sugarcane agronomy, varietal breeding, pest management, and crop statistics, UPCSR conducts pioneering research on high-yielding sugarcane varieties, disease resistance, and cultivation practices to boost productivity across major sugar-producing belts in the state.

76. (C) I, II, and IV only
Uttar Pradesh is a leading producer of sugarcane in India. The state Cane Department maps bonded acreage digitally using satellite imagery and GPS. State Advised Prices apply to all operating sugar mills in the state. However, FRP and SAP payments are legally disbursed by processing sugar mills, not funded by central government treasury.

77. (D) Median
When a crop yield dataset contains extreme values or extreme outliers—such as complete crop failures in hailed areas alongside bumper harvests elsewhere—the arithmetic mean is severely distorted. The median represents the middle value of an ordered dataset, making it resilient to extreme outliers and providing a less distorted measure of central tendency.

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20. (D) A floor price is paid if recovery exceeds a statutory minimum threshold
Under the Fair and Remunerative Price regime, price reductions are permitted if sugar recovery falls below the benchmark level, but the government fixes a statutory minimum floor price threshold. Even if a sugar mill records a recovery lower than that minimum threshold level, farmers are legally guaranteed to receive the specified floor price.

21. (B) Food Corporation of India (FCI)
The Food Corporation of India, established under the Food Corporations Act, 1964, acts as the primary central nodal agency responsible for executing Minimum Support Price operations for wheat and paddy. FCI, along with state government procurement agencies, undertakes direct purchasing, quality inspection, handling, and logistics storage to maintain central grain reserves.

22. (A) NAFED
The National Agricultural Cooperative Marketing Federation of India Ltd is the central nodal agency for procuring oilseeds, pulses, and copra under the Price Support Scheme. When market prices fall below declared MSP rates, NAFED intervenes in primary markets to absorb surplus arrivals, preventing distress sales by pulse and oilseed farmers.

23. (C) Grains procured at MSP are stored and distributed via PDS
MSP operations and the Public Distribution System are structurally interconnected components of national food policy. Grains procured from farmers at MSP by central and state agencies build the central stock buffer. These stored foodgrains are subsequently allocated and distributed to eligible beneficiaries at subsidized issue prices through the network of PDS fair price shops.

24. (A) I, II, and III only
The Government of India officially announces MSP for 22 mandated crops (comprising 14 Kharif crops, 6 Rabi crops, and 2 commercial crops) along with FRP for sugarcane. Commercial crops under MSP include copra and raw jute. Perishable horticultural crops like potatoes and onions are not part of the mandatory MSP regime.

25. (D) Cover and Plinth storage
Cover and Plinth (CAP) storage is an outdoor storage method utilized by procurement organizations like FCI during peak arrivals. Stacked bag piles of grain are arranged on raised brick or concrete platforms (plinths) and covered with heavy, weatherproof polyethylene covers secured with ropes to protect grain from environmental damage when indoor warehouse space is limited.

26. (B) Remote Sensing through satellites
Remote sensing technology utilizes multispectral spatial imagery collected by Earth observation satellites to measure crop land area and assess vegetation vigor. Advanced digital analysis of satellite reflectance data enables agricultural statisticians and research institutes to forecast crop acreage, evaluate plant health, and estimate yield potential well before the final field harvesting season.

27. (D) Forecasting Agricultural output using Space, Agro-meteorology and Land based observations
The FASAL scheme, operationalized under the Department of Agriculture and Farmers Welfare, stands for Forecasting Agricultural output using Space, Agro-meteorology and Land based observations. It integrates satellite remote sensing imagery, weather parameters, and ground-level field inputs to produce multiple in-season pre-harvest crop production forecasts for major agricultural commodities across the nation.

28. (A) Mapping and analyzing spatial data on crop acreage and yields
Geographic Information System technology provides a digital framework for capturing, storing, managing, and analyzing geographically referenced spatial data. In agricultural statistics, GIS overlays satellite imagery, administrative boundary maps, soil profiles, and weather data to map crop acreage patterns, monitor spatial variations in yield, and facilitate efficient regional agricultural land-use planning.

29. (C) Providing crop estimates via space technology
The Mahalanobis National Crop Forecast Centre, located in New Delhi under the Ministry of Agriculture, is a specialized institution established to operationalize space technology applications. MNCFC regularly utilizes satellite remote sensing imagery, GIS, and agro-

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CHAPTER 26
Agricultural Marketing

1. What is the primary definition of agricultural marketing in the context of crop production?
(A) The physical transportation of seeds to the farm
(B) The entire process of moving an agricultural product from the farm to the final consumer
(C) The process of applying fertilizers and pesticides in the field
(D) The administrative mechanism of allocating land records to farmers

2. Under the traditional agricultural marketing system, what is the primary objective of establishing an Agricultural Produce Market Committee (APMC)?
(A) To collect income tax from marginal farmers
(B) To strictly prohibit the sale of agricultural produce outside the state
(C) To distribute free agricultural implements to laborers
(D) To ensure that farmers are not exploited by intermediaries and get a fair price

3. In Uttar Pradesh, the distribution of sugarcane supply tickets to farmers is primarily managed by which entity?
(A) Cane Cooperative Societies
(B) Agricultural Produce Market Committee (APMC)
(C) Food Corporation of India (FCI)
(D) State Trading Corporation (STC)

4. Match the agricultural initiatives in List I with their primary marketing focus in List II:
List I: (Agricultural Initiative)
P. e-NAM
Q. Kisan Rail
R. AGMARK
S. APEDA
List II: (Primary Marketing Focus)
1. Quality certification of agricultural products
2. Export promotion of scheduled agricultural products
3. Electronic trading portal for national market integration
4. Subsidized transportation of perishable agricultural goods
(A) P-4, Q-3, R-2, S-1
(B) P-3, Q-1, R-4, S-2
(C) P-3, Q-4, R-1, S-2
(D) P-1, Q-2, R-3, S-4

5. In which year was the National Agriculture Market (e-NAM) scheme officially launched by the Government of India?
(A) 2014
(B) 2016
(C) 2018
(D) 2020

6. What is the primary role of a Farmer Producer Organization (FPO) in the agricultural marketing channel?
(A) To act as a regulatory authority responsible for fixing and enforcing the Minimum Support Price
(B) To guarantee and disburse minimum daily wages directly to landless agricultural farm laborers
(C) To issue statutory trading licenses to registered wholesale merchants operating in APMC mandis
(D) To aggregate the produce of small farmers to enhance their collective market bargaining power

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Consider the following statements regarding Contract Farming:
I. It helps in reducing the price and market risks for the farmers.
II. Farmers are completely exempted from using fertilizers under contract farming.
III. The sponsor provides assured procurement of the crop at a pre-agreed price.
Which of the above statement(s) is/are correct?
(A) I and II only
(B) II and III only
(C) I and III only
(D) I, II, and III

8. The Agricultural Produce (Grading and Marking) Act, which provides the legal framework for

congestion and maintaining orderly processing schedules during crushing seasons.

39. (B) 14 days
Under Clause 3(3) of the Sugarcane (Control) Order, 1966, sugar mills are statutorily required to make full payment for delivered sugarcane to growers within 14 days of delivery. If a mill fails to pay within this 14-day statutory period, it is liable to pay interest on the delayed amount at prescribed annual rates.

40. (B) Ensuring systematic supply of mature cane to mills during crushing season
A cane calendar is a structured operational schedule developed by sugar mills and cane cooperative societies. It tracks bonded acreage, crop maturity, and farmer-wise quotas to issue supply tickets systematically. This ensures a continuous, regulated supply of freshly harvested mature sugarcane to processing mills throughout the crushing season while preventing processing delays.

41. (B) The percentage of sugar recovered per 100 kg of crushed cane
The sugar recovery rate measures the total weight of white sugar extracted during industrial crushing relative to the total weight of raw sugarcane processed, expressed as a percentage. A base recovery rate represents the standard recovery benchmark per 100 kilograms of sugarcane used by government authorities to establish baseline pricing.

42. (A) I and II only
Fair and Remunerative Price provides a mandatory statutory floor price for sugarcane, ensuring payment security for growers regardless of a sugar mill's financial status. Higher recovery percentages entitle farmers to additional premium payments above the base FRP. However, FRP does not replace SAP in states like Uttar Pradesh, where SAP continues to apply.

43. (D) Agmarknet
Agmarknet (Agricultural Marketing Information Network) is a digital portal executed by the Directorate of Marketing & Inspection under the Ministry of Agriculture. It links wholesale agricultural markets across India to collect and disseminate real-time daily data on market arrivals, minimum prices, maximum prices, and modal market prices for major agricultural commodities.

44. (B) It is conducted annually to track real-time yield fluctuations
The Agriculture Census in India is conducted at quinquennial intervals (every five years) rather than annually. It collects detailed structural data on land operational holdings, land tenancy, land usage patterns, cropping intensity, and irrigation distribution. Real-time annual yield estimation and harvest tracking are handled separately through Crop Cutting Experiments and seasonal agricultural surveys.

45. (B) Area $\times$ Yield
In agricultural statistics, total agricultural production for a crop is calculated mathematically as the product of total cultivated area and yield per unit area (Production = Area $\times$ Yield). Cultivated area is measured in hectares, while yield is expressed in tonnes or kilograms per hectare to determine overall physical harvest output.

46. (D) The yield was identical across all fields in the block
Variance measures the statistical dispersion or spread of numerical data values around their arithmetic mean. If the variance of sugarcane yield data across a block is equal to zero, it demonstrates mathematically that there is no variation among observations, meaning that every surveyed field in the block recorded the exact same yield value.

47. (B) Index of Terms of Trade for Agriculture
The Index of Terms of Trade for Agriculture measures the ratio of prices received by farmers for selling agricultural produce to prices paid by farmers for purchasing consumer goods, industrial products, and agricultural production inputs. An index above 100 indicates favorable economic purchasing terms for the farm sector relative to other sectors.

48. (A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).
Effective MSP implementation requires government purchasing entities to intervene in physical grain markets when open-market prices drop below declared support levels. Because procurement agencies must physically purchase,

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17. The first 'Kisan Rail', introduced to ensure seamless supply of perishable produce across the country, was flagged off between which two stations?
(A) Lucknow (Uttar Pradesh) to Howrah (West Bengal)
(B) Devlali (Maharashtra) to Danapur (Bihar)
(C) Nashik (Maharashtra) to Azadpur (New Delhi)
(D) Surat (Gujarat) to Gorakhpur (Uttar Pradesh)

18. In agricultural marketing, what does the term 'value chain development' primarily imply?
(A) Increasing the structural length of marketing channels through the strategic addition of intermediaries
(B) Inducing artificial price inflation of harvested commodities through speculative market hoarding practices
(C) Intentionally reducing product quality standards to minimize overall handling and transit expenses
(D) Adding economic value to a product at every stage from initial production to final consumption

19. Match the standard marks/agencies in List I with their corresponding domain in List II:
List I: (Standard Mark/Agency)
P. FSSAI
Q. BIS
R. AGMARK
S. CWC
List II: (Domain)
1. Storage and warehousing of agricultural produce
2. Certification of agricultural and allied commodities
3. Food safety and standard compliance in processed foods
4. Standardization of industrial and consumer goods
(A) P-3, Q-4, R-2, S-1
(B) P-2, Q-3, R-1, S-4
(C) P-3, Q-2, R-4, S-1
(D) P-4, Q-1, R-2, S-3

20. According to Shepherd's formula for calculating marketing efficiency (ME = (V/I) - 1), what does the variable 'I' represent?
(A) Total volume of agricultural produce
(B) Total value of goods sold
(C) Total marketing cost and margins
(D) Income tax paid by the farmer

21. Which portal/application was explicitly launched by the Uttar Pradesh Cane Development Department to digitize the distribution of supply tickets (purchi) and eradicate the sugarcane mafia?
(A) E-Ganna App
(B) E-Rakam
(C) E-Mandi UP
(D) Kisan Suvidha

22. Given below are two statements, one labelled as Assertion (A) and the other as Reason (R).
Assertion (A): Direct marketing allows farmers to realize higher returns for their produce.
Reason (R): Direct marketing eliminates the chain of middlemen, thereby reducing the marketing margin and price spread.
Select the correct answer using the options given below:
(A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
(B) Both Assertion (A) and Reason (R) are true but R is not the correct explanation of A.
(C) Assertion (A) is true but Reason (R) is false.
(D) Assertion (A) is false but Reason (R) is true.

23. In an agricultural marketing channel, a middleman who buys the produce, takes physical possession, assumes the legal title, and sells it at a profit is known as:
(A) A Commission Agent
(B) A Merchant Middleman
(C) A Speculative Broker
(D) An Institutional Facilitator

24. NAFED is the apex organization of marketing cooperatives for agricultural produce in India. In which year was NAFED established?
(A) 1958
(B) 1965
(C) 1982
(D) 1991

25. Consider the following statements regarding Cooperative Marketing:
I. It helps farmers secure better prices by selling produce in bulk.
II. It completely prevents the government from procuring food grains.
III. It facilitates the creation of common storage and transport facilities for members.
Which of the above statement(s) is/are correct?

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organization developed the BHIM UPI system often integrated into these digital payments?
(A) Reserve Bank of India (RBI)
(B) NPCI (National Payments Corporation of India)
(C) Securities and Exchange Board of India (SEBI)
(D) National Bank for Agriculture and Rural Development (NABARD)

76. The 'Kisan Suvidha' mobile application assists farmers in marketing by providing real-time data on:
(A) Online streaming schedules and digital subscriptions for urban entertainment movies
(B) Weather forecasts, market prices, and crop protection advice
(C) Real-time vacancy updates for skilled government and administrative jobs in metropolitan cities
(D) Direct seat reservations and ticketing services for commercial domestic and international airlines

77. To effectively influence farmer's decision-making regarding crop sowing, when does the Government of India typically announce the Minimum Support Price (MSP)?
(A) Prior to the start of the crop sowing season
(B) Immediately following the completion of full-scale field harvesting operations
(C) Exclusively during severe market emergencies when open market prices experience drastic crashes
(D) At the exact physical moment when harvested produce arrives at the regulated mandi auction yard

78. In an APMC market yard, the auction of agricultural produce is ideally conducted by:
(A) Secret bidding conducted strictly through private whispers between buyers and commission agents
(B) A randomized token draw managed solely under the administrative direction of the APMC secretary
(C) Open transparent auction among competing buyers
(D) Mandatory price fixation enforced directly by senior local political authorities attending the market

79. The financial concept of 'Pledge Financing' or 'Negotiable Warehouse Receipt (NWR)' system in agricultural marketing helps farmers primarily by:
(A) Granting farmers permanent legal titles and property ownership over public warehouse infrastructure
(B) Automatically settling all outstanding commercial bank crop loans using state subsidy emergency funds
(C) Distributing certified high-yielding seeds and agrochemicals free of cost for the subsequent planting season
(D) Enabling credit against stored produce to avoid distress sales during low prices

80. In Uttar Pradesh, the statutory deduction made from the sugarcane price payable to farmers, which is used explicitly for the development of roads and infrastructure around the mill area, is known as:
(A) Central Personal Income Tax Assessment
(B) Statutory Customs Export Tariff Duty
(C) Cane Development Commission
(D) Integrated Goods and Services Tax Levy

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35. The headquarters of the Directorate of Marketing and Inspection (DMI), which implements various agricultural marketing policies of the Central Government, is located at:
(A) Faridabad
(B) Lucknow
(C) Pune
(D) Hyderabad

36. Match the types of agricultural markets in List I with their primary characteristic in List II:
List I: (Market Type)
P. Primary Wholesale Market
Q. Secondary Wholesale Market
R. Terminal Market
S. Retail Market
List II: (Primary Characteristic)
1. Market where produce is finally disposed of to consumers or processors
2. Market held locally where farmers directly bring their raw produce
3. Market where transactions occur in small quantities directly with consumers
4. Market located at district headquarters dealing mostly with local traders
(A) P-1, Q-2, R-3, S-4
(B) P-4, Q-3, R-2, S-1
(C) P-2, Q-4, R-1, S-3
(D) P-2, Q-1, R-4, S-3

37. To facilitate a more unified and competitive marketing environment, the Central Government released the Model APLM (Agricultural Produce and Livestock Marketing) Act in which year?
(A) 2003
(B) 2017
(C) 2020
(D) 2022

38. Which transportation scheme was specifically launched by the Government to assist farmers in transporting agricultural products on international and national air routes, focusing heavily on North-Eastern and tribal areas?
(A) Kisan Rail
(B) Vande Bharat Krishi
(C) PM Gati Shakti Agni
(D) Krishi Udan

39. In the sugarcane marketing system of Uttar Pradesh, what is meant by the term "Cane Command Area" or "Reserved Area"?
(A) A legally restricted agricultural zone where only certified organic sugarcane cultivation is permitted by state authorities
(B) A designated administrative zone where all grown sugarcane must exclusively be supplied to a specific sugar mill
(C) An environmentally fragile zone where sugarcane cultivation is strictly prohibited due to severe regional water scarcity
(D) A state-managed research facility and seed multiplication farm dedicated exclusively to elite cane variety propagation

40. Consider the following issues related to agricultural marketing in India:
I. Lack of adequate scientific storage facilities at the village level.
II. Forced or distress sale by marginal farmers to village moneylenders.
III. High standardization and grading of produce at the farm gate.
Which of the above statement(s) is/are correct?
(A) I and II only
(B) II and III only
(C) I and III only
(D) I, II, and III

41. Which of the following statements regarding Rural Haats (village markets) is incorrect?
(A) They serve as the initial physical contact point within the marketing channel for small and marginal farmers.
(B) Transactions occurring in rural haats predominantly involve small, un-graded lots of varied agricultural produce.
(C) They routinely lack basic post-harvest infrastructure facilities including cold stores and electronic weighbridges.
(D) They operate as highly regulated markets strictly governed by statutory APMC provisions.

42. In agricultural marketing, a situation where the "Marketed Surplus" is greater than the "Marketable Surplus" clearly indicates:
(A) Distress sale by the farmer
(B) A highly profitable export market
(C) Excessive government procurement
(D) High efficiency of the marketing channel

43. Under the e-NAM scheme, how is the payment primarily settled between the buyer and the farmer to ensure transparency?
(A) Through post-dated physical demand drafts or cheques issued directly by the APMC market secretary

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(A) I only
(B) II and III only
(C) I and III only
(D) I, II, and III

26. Which government body is specifically mandated with the responsibility of export promotion and development of scheduled agricultural products like fruits, vegetables, and meat?
(A) APEDA
(B) FCI
(C) NITI Aayog
(D) ICAR

27. The organized supply and purchase of sugarcane in Uttar Pradesh is legally governed by the provisions of which primary Act?
(A) The Essential Commodities Act, 1955
(B) The U.P. Sugarcane (Regulation of Supply and Purchase) Act, 1953
(C) The U.P. Agricultural Produce Markets Act, 1964
(D) The Model APMC Act, 2003

28. Select the correct marketing channel that represents the longest physical and economic route from producer to consumer.
(A) Producer → Consumer
(B) Producer → Retailer → Consumer
(C) Producer → Wholesaler → Retailer → Consumer
(D) Producer → Primary Wholesaler → Secondary Wholesaler → Retailer → Consumer

29. Which of the following is a prominent digital portal implemented by the Directorate of Marketing and Inspection (DMI) to provide daily market price and arrival information to farmers?
(A) Agmarknet
(B) Bhoomi
(C) Khajane
(D) e-Choupal

30. Proper storage in the agricultural marketing chain primarily creates which type of economic utility for the produce?
(A) Form utility
(B) Place utility
(C) Time utility
(D) Possession utility

31. Consider the following statements about Farmer Producer Organizations (FPOs):
I. They operate as registered legal entities under the Companies Act or Cooperative Societies Act.
II. They enable small farmers to collectively procure agricultural inputs at wholesale rates.
III. They guarantee employment to urban youth in the agriculture sector.
IV. They facilitate better access to institutional credit and government schemes for their members.
Which of the above statement(s) is/are correct?
(A) I, II, and III
(B) I, II, and IV
(C) II, III, and IV
(D) I, III, and IV

32. Which agency acts as the lead implementing agency for the National Agriculture Market (e-NAM) under the Ministry of Agriculture and Farmers Welfare?
(A) National Informatics Centre (NIC)
(B) Directorate of Marketing and Inspection (DMI)
(C) Small Farmers Agribusiness Consortium (SFAC)
(D) Indian Council of Agricultural Research (ICAR)

33. For optimal marketing and milling quality in sugarcane, what is the standard maturity index measured via a hand refractometer just before harvesting?
(A) Brix reading of 8 to 10%
(B) Brix reading of 12 to 14%
(C) Brix reading of 18 to 20%
(D) Brix reading of 25 to 28%

34. Given below are two statements, one labelled as Assertion (A) and the other as Reason (R).
Assertion (A): Assaying (quality testing) is a mandatory and critical step before agricultural produce can be traded on the e-NAM platform.
Reason (R): Assaying builds trust among distant buyers regarding the exact grade and quality of the produce being auctioned electronically.
Select the correct answer using the options given below:
(A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
(B) Both Assertion (A) and Reason (R) are true but R is not the correct explanation of A.
(C) Assertion (A) is true but Reason (R) is false.
(D) Assertion (A) is false but Reason (R) is true.

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List I: (Agricultural Organization)
P. CACP
Q. FCI
R. SFAC
S. NCDC
List II: (Primary Operational Role)
1. Implementing agency for e-NAM and promotion of FPOs
2. Procurement, storage, and distribution of food grains
3. Recommends MSP for mandated agricultural crops
4. Planning and promoting cooperative programs
(A) P-3, Q-2, R-1, S-4
(B) P-2, Q-3, R-4, S-1
(C) P-3, Q-1, R-2, S-4
(D) P-1, Q-2, R-3, S-4

52. The Government of India operates a toll-free 'Kisan Call Centre' to provide immediate technical and market-related information to farmers. What is the toll-free number?
(A) 1800-180-1551
(B) 1800-111-2222
(C) 1800-180-1991
(D) 1800-120-1000

53. Which of the following best describes the phenomenon of "Distress Sale" by a farmer?
(A) Post-harvest crop sale at low prices due to urgent cash needs and storage shortage
(B) Disposing of commercial agricultural produce directly to sugar processing factories under legally binding procurement contracts
(C) Exporting high-grade harvested commodities to overseas international markets to capitalize on lucrative premium price margins
(D) Selling surplus harvested grains to designated state procurement agencies at the prevailing statutory Minimum Support Price

54. At the central level, the Fair and Remunerative Price (FRP) of sugarcane is formally approved and announced by which authority?
(A) Union Ministry of Commerce and Industry upon recommendation of export promotion bodies
(B) Reserve Bank of India acting through its specialized agricultural credit policy division
(C) Governing Council of NITI Aayog operating under the executive chairmanship of the Prime Minister
(D) Cabinet Committee on Economic Affairs (CCEA) chaired by the Prime Minister of India

55. Consider the following statements regarding AGMARK:
I. It acts as a quality certification mark for agricultural products in India.
II. It is legally mandatory for a farmer to obtain an AGMARK certificate to sell raw wheat in a local mandi.
III. The certification is implemented by the Directorate of Marketing and Inspection (DMI).
Which of the above statement(s) is/are correct?
(A) I only
(B) I and II only
(C) I and III only
(D) I, II, and III

56. What is the primary purpose of the 'Agmarknet' portal in the context of information technology in agricultural marketing?
(A) Facilitating the online retail distribution of heavily subsidized chemical fertilizers and bio-inputs directly to smallholders
(B) Managing subsidized railway ticket reservations and travel logistics for seasonal agricultural labor migrant groups
(C) Disseminating daily market arrivals and wholesale prices of various agricultural commodities
(D) Generating and issuing digitized soil health cards detailing field nutrient status to registered farming households

57. Among the following intermediaries in a standard marketing channel, which one acts merely on behalf of the principal without taking ownership of the goods?
(A) Primary Wholesale Merchant
(B) Independent Local Retailer
(C) Village Merchant and Money Trader
(D) Commission Agent (Adhatiya)

58. Converting raw mangoes into pickles or raw sugarcane into jaggery (gur) creates which type of utility in the marketing chain?
(A) Form utility
(B) Time utility
(C) Place utility
(D) Possession utility

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parameters, and trade reliability in domestic agricultural marketing channels.

9. (A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
The Minimum Support Price operates as an economic floor price established by the government to protect farmers during supply gluts. When market prices fall below this threshold, government agencies step in to buy standard quality crops at the announced rate. This mechanism directly prevents distress sales and guarantees minimum income for agricultural producers.

10. (A) Gramin Agricultural Markets
Gramin Agricultural Markets, abbreviated as GrAMs, are physical rural market centers targeted for infrastructure upgrading in India. The initiative enhances thousands of periodic village markets with modern amenities. Linked digitally to e-NAM, GrAMs help small farmers access transparent price discovery and sell produce closer to their farm gates without traveling long distances.

11. (B) State Advised Price (SAP)
The State Advised Price is the statutory procurement price fixed annually by specific state governments, including Uttar Pradesh, for sugarcane purchases by private and cooperative sugar mills. The State Advised Price is generally set higher than the central Fair and Remunerative Price, ensuring that sugarcane growers receive enhanced remuneration reflective of regional production costs and economic conditions.

12. (B) II, III, I
In the institutional sugarcane supply framework of Uttar Pradesh, the primary producer is the sugarcane farmer. The harvested cane is routed through the local Cane Cooperative Society, which allocates supply slips and organizes orderly dispatches. Finally, the produce is delivered directly to the designated sugar mill for processing, completing the supply sequence from farm level to industrial processing.

13. (A) A long intermediary chain always yields higher returns for the primary producer.
A long marketing chain with multiple intermediaries generally reduces returns for the primary agricultural producer because each middleman deducts margins and handling costs, widening the total price spread. While intermediaries provide essential services like aggregation, transport, and financing, excessive stages dilute the final percentage share of the retail price received by farmers at the origin.

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14. (C) Pre-cooling unit
A pre-cooling unit is an indispensable component of cold-chain infrastructure designed for perishable horticultural crops. Rapid removal of field heat immediately post-harvest slows down respiration rates, reduces moisture loss, and inhibits thermal deterioration. This preserves produce quality, extends post-harvest shelf life, and ensures the effective transportation of fruits and vegetables through temperature-controlled supply channels to distant markets.

15. (B) I, III, and IV
The Electronic National Agriculture Market integrates physical mandis onto an electronic portal, facilitating pan-India agricultural trading and unified informational services. States must amend their APMC Acts to issue unified licenses and permit electronic trading. Crucially, the platform operates within existing physical market infrastructure rather than abolishing physical APMC yards, enhancing market access while retaining local logistics facilities.

16. (C) Commission for Agricultural Costs and Prices (CACP)
The Commission for Agricultural Costs and Prices is the statutory advisory body responsible for recommending the Fair and Remunerative Price for sugarcane in India. It analyzes factors such as production costs, yield trends, sugar recovery rates, and market supply dynamics. These comprehensive evaluations guide central policy decisions to safeguard sugarcane farmers' income while balancing sugar mill viability.

17. (B) Devlali (Maharashtra) to Danapur (Bihar)
India's first Kisan Rail service was officially flagged off on August 7, 2020, connecting Devlali in Maharashtra to Danapur in Bihar. Operated by Indian Railways, this specialized multi-commodity train service was established to ensure rapid, cost-effective transportation of perishable agricultural goods like vegetables and fruits across long geographical distances, minimizing post-harvest losses.

(B) Import and operation of heavy earth-moving machinery like bulldozers
(C) Acquisition and operation of international ocean cargo transport ships
(D) Scientific storage capacity and rural godowns

67. The central sector scheme 'Operation Greens', which initially focused on TOP (Tomato, Onion, Potato) crops to stabilize their supply and prices, provides a 50% subsidy on which marketing aspect?
(A) Transportation and cold storage facilities
(B) Procurement of high-yielding hybrid seeds and planting materials
(C) Sinking deep borewells and installing micro-irrigation systems
(D) Payment of annual commercial crop insurance policy premiums

68. As per the general guidelines of SFAC for the formation of Farmer Producer Organizations (FPOs) in plain areas, what is the minimum required number of farmer members?
(A) 10
(B) 50
(C) 300
(D) 1000

69. In the context of international agricultural marketing, what does "Codex Alimentarius" refer to?
(A) International food standards, codes of practice, and safety guidelines
(B) A unified global customs tariff framework designed specifically for regulating and taxing cross-border agricultural imports
(C) A specialized agricultural trade subsidy mechanism implemented across European Union member nations to support wheat growers
(D) A legally binding international environmental treaty establishing a total global ban on synthetic chemical fertilizers

70. The total difference between the price paid by the ultimate consumer and the price received by the primary agricultural producer is technically known as:
(A) Market Equilibrium
(B) Consumer Surplus
(C) Retained Earnings
(D) Price Spread

71. In modern Controlled Atmosphere (CA) storage used for extending the shelf life of highly perishable fruits in the marketing chain, which specific gas is strictly managed to delay the ripening process?
(A) Nitrogen dioxide
(B) Ethylene
(C) Methane
(D) Sulfur dioxide

72. Which cooperative institution serves as the apex body for marketing agricultural inputs and produce specifically within the state of Uttar Pradesh?
(A) NAFED (National Agricultural Cooperative Marketing Federation)
(B) UPICA (Uttar Pradesh Industrial Cooperative Association)
(C) PCF (Pradeshik Cooperative Federation)
(D) IFFCO (Indian Farmers Fertiliser Cooperative)

73. Which of the following sugarcane diseases causes rapid inversion of sucrose into glucose and fructose, severely degrading the cane's milling quality and marketing value?
(A) Grassy Shoot
(B) Ratoon Stunting
(C) Smut
(D) Red Rot

74. What is the fundamental difference between a traditional 'Supply Chain' and a 'Value Chain' in agriculture?
(A) Supply chain focuses on efficient movement of produce; value chain focuses on adding value through processing and branding.
(B) A value chain completely excludes physical transport activities, whereas a supply chain deals exclusively with freight logistics and vehicle transit.
(C) A supply chain is restricted entirely to international export marketing operations, whereas a value chain applies exclusively to localized domestic trade.
(D) There is no economic distinction between the two concepts; both terms represent identical operational procedures in commercial agribusiness systems.

75. In order to integrate physical markets and prevent delays in farmer payments, e-NAM utilizes a unified payment gateway. Which

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(B) Via direct electronic fund transfer into the registered bank account of the farmer
(C) Through spot cash handovers conducted directly between the buyer and seller inside the mandi yard
(D) Through non-monetary kind payments consisting of subsidized agricultural inputs like fertilizers and seeds

44. Select the correct sequence of fundamental processes involved in the value addition of sugarcane to produce white crystal sugar at a mill:
(A) Crystallization → Extraction → Centrifugation → Clarification
(B) Extraction → Clarification → Crystallization → Centrifugation
(C) Clarification → Extraction → Centrifugation → Crystallization
(D) Extraction → Crystallization → Clarification → Centrifugation

45. In Uttar Pradesh, sugarcane weighment at mill gates and purchasing centres is closely monitored to prevent fraud. Who is primarily responsible for inspecting these weighments on behalf of the farmers?
(A) Joint teams of local Cane Cooperative Society and state Cane Department staff
(B) Designated food safety inspectors from the Food Safety and Standards Authority of India
(C) Exclusively authorized revenue officers under the direct supervision of Sub-Divisional Magistrates
(D) Technical audit representatives deputed from the Agricultural and Processed Food Products Export Development Authority

46. Given below are two statements, one labelled as Assertion (A) and the other as Reason (R).
Assertion (A): The development of a cold-chain facility is crucial for marketing horticultural crops like tomatoes and apples.
Reason (R): Cold-chain infrastructure slows down physiological processes and microbial growth, thereby drastically reducing post-harvest losses.
Select the correct answer using the options given below:
(A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
(B) Both Assertion (A) and Reason (R) are true but R is not the correct explanation of A.
(C) Assertion (A) is true but Reason (R) is false.
(D) Assertion (A) is false but Reason (R) is true.

47. The physical transportation of agricultural produce via trucks or railways from a surplus region to a deficit region creates which type of utility?
(A) Form utility
(B) Time utility
(C) Possession utility
(D) Place utility

48. Consider the following statements regarding the objectives of the Minimum Support Price (MSP) system:
I. To prevent a sharp fall in the price of agricultural produce during bumper harvest seasons.
II. To assure farmers of a remunerative price for their crops.
III. To maximize the profit margins of private wholesale traders.
IV. To encourage farmers to adopt modern technologies and increase production.
Which of the above statement(s) is/are correct?
(A) I, II, and III
(B) I, II, and IV
(C) II, III, and IV
(D) I, III, and IV

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49. 'Apni Mandi' in Punjab and 'Rythu Bazar' in Andhra Pradesh are successful examples of which type of agricultural marketing?
(A) Vertically integrated cooperative marketing societies operating across state boundaries
(B) Direct marketing channels linking agricultural farmers straight to final consumers
(C) Speculative forward trading and futures market contracts under commodity exchanges
(D) Specialized international export marketing networks driven by private trade syndicates

50. In the commercial marketing of sugarcane, the calculation of Commercial Cane Sugar (CCS) percentage is fundamentally based on which two analytical parameters of cane juice?
(A) pH and Turbidity
(B) Reducing sugars and Ash content
(C) Fiber content and Nitrogen percentage
(D) Brix and Pol (Sucrose) percentage

51. Match the agricultural organizations in List I with their primary operational role in List II:

ANSWERS

1. (B) The entire process of moving an agricultural product from the farm to the final consumer
Agricultural marketing encompasses all operations involved in the movement of agricultural produce from the point of initial harvest at the farm gate to the ultimate consumer. This process includes critical functions such as assembling, grading, storage, transportation, processing, and distribution, ensuring that agricultural goods effectively reach retail consumers while maximizing value for producers.

2. (D) To ensure that farmers are not exploited by intermediaries and get a fair price
Agricultural Produce Market Committees were established as statutory market boards by state governments to regulate primary agricultural trade. Their principal objective is to protect farmers from unfair trading practices, excessive commission charges, and manipulative weight measurements by intermediaries. By providing transparent auctioning mechanisms in regulated market yards, they ensure competitive pricing and fair economic returns for agricultural producers.

3. (A) Cane Cooperative Societies
In Uttar Pradesh, Cane Cooperative Societies play a pivotal institutional role in the structured supply management of sugarcane to sugar processing mills. These cooperatives manage farmer registrations, calculate individual crop supply quotas, and issue supply tickets, locally known as purchis. This systematic distribution prevents market chaos, minimizes mill supply gluts, and ensures equitable selling opportunities for registered cane growers.

4. (C) P-3, Q-4, R-1, S-2
Electronic National Agriculture Market functions as an electronic trading portal creating a unified national market. Kisan Rail provides subsidized rail transportation dedicated to moving perishable produce swiftly. AGMARK offers statutory quality certification for agricultural commodities. Agricultural and Processed Food Products Export Development Authority acts as the apex statutory body responsible for promoting and developing exports of scheduled agricultural items.

5. (B) 2016
The National Agriculture Market scheme, commonly known as e-NAM, was officially launched by the Government of India on April 14, 2016. Conceived as a pan-India electronic trading portal, it links existing Agricultural Produce Market Committee mandis across states. The scheme aims to create a unified national market for agricultural commodities, enhancing price discovery and trade transparency.

6. (D) To aggregate the produce of small farmers to enhance their collective market bargaining power
Farmer Producer Organizations serve as primary collective institutions that aggregate produce from small and marginal agricultural producers. By pooling harvests, these organizations achieve economies of scale in bulk purchasing of inputs, transportation, storage, and processing. This collective approach drastically strengthens farmers' bargaining power against large buyers, reduces transaction overheads, and enables direct market linkages for superior income realization.

7. (C) I and III only
Contract farming establishes an advance agreement between agricultural producers and commercial buyers for crop production and marketing. This structure significantly mitigates price and market risks for farmers through assured procurement at pre-agreed financial terms. However, farmers remain responsible for crop management using recommended inputs, meaning they are never entirely exempted from applying fertilizers or managing field operations effectively.

8. (A) 1937
The Agricultural Produce Grading and Marking Act was enacted by the Central Legislature in 1937. This landmark legislation established the statutory foundation for quality standardization and grading of agricultural and allied commodities across India. It authorizes the application of the AGMARK certification quality stamp, ensuring consumer protection, standard quality

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59. In the context of sugarcane marketing, what is the meaning of a 'Premium' price given over and above the standard SAP/FRP?
(A) A compensatory monetary allowance paid to farmers in cases of delayed crop harvesting schedules
(B) Extra payment for early-maturing cane varieties yielding higher sugar recovery
(C) A financial penalty deducted by sugar mills for deliveries containing excessive trash and binding materials
(D) An incentive bonus distributed exclusively to progressive farmers possessing motorized agricultural tractors

60. The grant of a Geographical Indication (GI) tag to an agricultural product (e.g., Kalanamak Rice of UP) aids in its marketing primarily by:
(A) Granting total exemption from all state level sales taxes and central goods and services duties
(B) Certifying its specific geographical origin and associated unique quality traits
(C) Legally mandating state procurement agencies to purchase the entire annual harvest yield at MSP
(D) Authorizing direct commercial distribution while bypassing statutory food safety and quality inspection protocols

61. The mathematical formula for "Marketable Surplus" of an agricultural commodity is best expressed as:
(A) Total Production - (Family Consumption + Seed + Feed + Kind Payments + Wastage)
(B) Total Regional Crop Production + International Import Volume - Total Export Volume
(C) Total Annual Market Arrivals / Total Scientific Warehousing and Storage Capacity
(D) Total Farm Production Volume prevailing Average Wholesale Open Market Selling Price

62. In agricultural marketing, the "Marketing Margin" of a specific intermediary is defined as:
(A) The gross monetary value of agricultural commodities sold multiplied by the prevailing statutory state tax rate
(B) The cumulative financial expenditure spent exclusively on regional freight transportation and commercial warehouse storage
(C) Selling price minus buying price and incurred marketing costs
(D) The final gross retail purchase price paid for the product by the ultimate end consumer in the open market

63. Under the standard functioning of an APMC, who manages the market yard and resolves disputes between farmers and traders?
(A) The local Police Inspector in charge of the municipal law and order administrative jurisdiction
(B) The chief branch manager of the nearest nationalized commercial bank operating in the district
(C) The elected village Sarpanch acting under exclusive discretionary administrative powers
(D) A Market Committee representing farmers, traders, and state government officials

64. A "Regulated Market" in agricultural economics refers strictly to a market where:
(A) A market structure where commodity prices are arbitrarily fixed by the monopoly of cartelized wholesale traders
(B) A restricted commercial zone where foreign direct investment and private corporate participation are completely prohibited
(C) Market transactions are governed by statutory rules and standardized weights
(D) An enforced trading post where agricultural producers are compelled to sell produce exclusively to state procurement agencies

65. The Uttar Pradesh Government's recent initiative to establish specialized 'Kisan Mandis' away from standard APMC yards primarily aims to promote:
(A) Large-scale interstate import of cheap agricultural commodities from neighboring states
(B) Direct marketing between agricultural farmers and bulk buyers or consumers
(C) Complete structural privatization of all rural arable agricultural land holdings
(D) Systematic statutory elimination of the Minimum Support Price framework across all crops

66. Under the Ministry of Agriculture's AMI (Agricultural Marketing Infrastructure) sub-scheme, financial assistance is predominantly provided for the creation of:
(A) Large-scale chemical fertilizer manufacturing and processing plants

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18. (D) Adding economic value to a product at every stage from initial production to final consumption
Value chain development in agriculture focuses on enhancing the economic value of commodities at every node of the supply system, from primary farming to final consumer delivery. By introducing post-harvest practices such as grading, cleaning, processing, packaging, and targeted branding, actors within the supply chain transform raw agricultural harvests into higher-value commercial products.

19. (A) P-3, Q-4, R-2, S-1
Food Safety and Standards Authority of India enforces safety and compliance standards for processed food products. Bureau of Indian Standards establishes quality standardization for industrial and consumer goods. AGMARK serves as a quality certification system specifically for agricultural commodities. Central Warehousing Corporation provides infrastructure facilities for scientific storage and warehousing of agricultural and commercial produce.

20. (C) Total marketing cost and margins
In Shepherd's formula for evaluating agricultural marketing efficiency, expressed as ME = (V/I) - 1, the variable 'V' denotes the total value of the produce sold at the retail level. The variable 'I' represents the total marketing costs incurred alongside intermediary margins. Higher values of 'V' relative to 'I' signify superior performance within marketing channels.

21. (A) E-Ganna App
The E-Ganna mobile application was developed by the Cane Development Department of Uttar Pradesh to digitize sugarcane marketing operations. The application provides farmers direct access to supply ticket status, crushing schedules, and weighment records. By eliminating non-transparent offline distribution of supply tickets, it effectively curtails middleman exploitation and streamlines sugarcane procurement for local growers.

22. (A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
Direct marketing enables farmers to market produce straight to consumers without going through commercial middlemen. Eliminating intermediaries reduces handling expenses and commission deductions, directly narrowing the price spread. Because the savings from reduced marketing margins are retained at the farm level, farmers realize significantly higher prices, demonstrating how eliminating middlemen directly improves overall agricultural producer income.

23. (B) A Merchant Middleman
A merchant middleman in an agricultural supply channel takes legal title and physical possession of commodities by purchasing them outright. By acquiring ownership, merchant middlemen assume financial, spoilage, and price fluctuation risks. They subsequently resell the produce to secondary buyers at a profit margin, unlike commission agents who act on service fees without taking ownership.

24. (A) 1958
The National Agricultural Cooperative Marketing Federation of India, known as NAFED, was established on October 2, 1958. It functions as the apex organization for marketing cooperatives dealing in agricultural produce nationwide. NAFED promotes cooperative marketing, manages market interventions, executes price support operations, and facilitates internal and international trade to protect farmers' economic interests.

25. (C) I and III only
Cooperative marketing empowers farmers to aggregate produce, secure competitive prices, and share joint storage and transit infrastructure. Rather than preventing government procurement, marketing cooperatives frequently act as key institutional agencies executing government price support schemes and purchasing food grains on behalf of state agencies. Thus, cooperatives actively support public procurement while enhancing member returns.

26. (A) APEDA
The Agricultural and Processed Food Products Export Development Authority is an autonomous statutory organization established under the Ministry of Commerce and Industry. It holds the mandate for promoting exports of scheduled agricultural items, including fresh fruits, vegetables, livestock products, and processed foods. APEDA provides financial assistance, market intelligence, and quality standard compliance for exporters.

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27. (B) The U.P. Sugarcane (Regulation of Supply and Purchase) Act, 1953
The regulation of sugarcane procurement and distribution in Uttar Pradesh is governed by the U.P. Sugarcane Regulation of Supply and Purchase Act of 1953. This primary state legislation provides the legal framework for reserving cane areas for sugar factories, regulating purchasing centers, establishing Cane Development Societies, and ensuring timely payment of sugarcane dues to growers.

28. (D) Producer → Primary Wholesaler → Secondary Wholesaler → Retailer → Consumer
A marketing channel containing a primary wholesaler, a secondary wholesaler, and a retailer represents the longest structural route between farm origin and final consumption. Each distinct intermediary step introduces additional transportation, handling, and administrative costs along with profit margins, extending the overall economic price spread and physical transit time of agricultural commodities.

29. (A) Agmarknet
Agmarknet is a comprehensive nationwide agricultural marketing portal launched by the Ministry of Agriculture and maintained by the Directorate of Marketing and Inspection. It collects and broadcasts real-time daily market arrivals and wholesale prices of agricultural commodities from regulated mandis across India, empowering farmers with accurate price discovery to make informed selling choices.

30. (C) Time utility
Proper scientific storage of agricultural produce primarily generates time utility within the marketing framework. Agricultural commodities are typically harvested during limited seasonal periods but consumed continuously throughout the year. Storage bridges the temporal gap between seasonal harvest supply and round-the-year demand, stabilizing market prices and ensuring a consistent supply of food grains for consumers.

31. (B) I, II, and IV
Farmer Producer Organizations are registered legal entities created under statutory company or cooperative acts to assist primary producers. They enable small farmers to aggregate input purchases at wholesale rates and improve institutional credit access. Their economic focus remains on farm input management, produce aggregation, and market linkages rather than guaranteeing urban employment.

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32. (C) Small Farmers Agribusiness Consortium (SFAC)
Small Farmers Agribusiness Consortium operates as the lead implementing agency for the National Agriculture Market scheme under the Ministry of Agriculture and Farmers Welfare. SFAC manages software implementation, coordinates mandi onboarding across states, facilitates financial integration, and supports capacity building to drive digital transformation and unified trading in primary agricultural markets.

33. (C) Brix reading of 18 to 20%
Sugarcane reaches optimal harvest maturity for commercial milling when the total soluble solids in the juice achieve a refractometer Brix reading of 18 to 20 percent. Measuring Brix at field conditions with a hand refractometer determines peak sucrose accumulation, ensuring maximum sugar extraction efficiency and optimized monetary value per ton during factory procurement.

34. (A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
Assaying provides scientific verification of commodity quality parameters before electronic bidding takes place on e-NAM. In digital platforms where buyers cannot physically inspect lots prior to purchase, standardized quality certificates foster trust among distant traders. Accurate assaying facilitates transparent electronic price discovery, proving essential for remote transactions and explaining why compulsory testing is required.

35. (A) Faridabad
The Directorate of Marketing and Inspection, an attached office under the Department of Agriculture and Farmers Welfare, maintains its head office at Faridabad, Haryana. The Directorate formulates policies for agricultural marketing, implements the AGMARK certification program, oversees market research, and provides technical guidance to states for establishing modern agricultural marketing infrastructure.

36. (C) P-2, Q-4, R-1, S-3
Primary wholesale markets are local yards where farmers directly sell un-graded raw harvests. Secondary wholesale markets usually operate at district centers, catering to local traders and regional aggregators. Terminal markets are located in major urban hubs where produce is finally disposed of to consumers or processors. Retail markets manage small-volume sales directly to end consumers.

37. (B) 2017
The Ministry of Agriculture released the State/UT Agricultural Produce and Livestock Marketing (Promotional and Facilitating) Act in 2017. This Model APLM Act aimed to replace existing APMC frameworks, encouraging competitive alternate trading channels, promoting direct farmer-buyer trade, permitting private wholesale markets, and removing legal barriers to integrate agricultural trade across state borders efficiently.

38. (D) Krishi Udan
The Krishi Udan scheme was launched by the Ministry of Civil Aviation to assist farmers in transporting agricultural goods via air cargo routes. It focuses particularly on North-Eastern, hilly, and tribal regions, facilitating swift freight transit for perishable commodities. This enhances air logistics connectivity and opens access to lucrative domestic and international high-value retail markets.

39. (B) A designated administrative zone where all grown sugarcane must exclusively be supplied to a specific sugar mill
In Uttar Pradesh, a Cane Command Area represents a designated geographical region allocated to a specific sugar mill under state statutory provisions. Farmers within this reserved zone supply their harvested sugarcane to that assigned mill, while the factory is required to purchase it. This structured zoning ensures regular cane supply for industrial processing.

40. (A) I and II only
Agricultural marketing in India faces severe challenges due to inadequate village-level scientific storage, forcing smallholders into distress sales to moneylenders due to immediate financial pressures. Furthermore, grading and standardization at the farm gate remain low, leading to un-sorted produce sales. High grading at origin is a desired solution rather than an existing operational constraint in agricultural supply chains.

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41. (D) They operate as highly regulated markets strictly governed by statutory APMC provisions.
Rural Haats are informal, traditional village markets functioning as initial physical trading assembly points for marginal farmers. Transactions in these markets generally involve un-graded, small commodity lots. Crucially, Rural Haats operate outside rigid statutory APMC regulations and lack formal administrative supervision, which is why government programs target them for infrastructural and regulatory modernizing upgrades.

42. (A) Distress sale by the farmer
Marketable surplus represents the theoretical excess output remaining after meeting farm requirements like family consumption, seed, feed, and labor payments. Marketed surplus is the actual quantity brought to market. When marketed surplus exceeds marketable surplus, farmers sell retained stocks essential for basic household consumption or seed needs, clearly signaling economic distress and immediate cash desperation.

43. (B) Via direct electronic fund transfer into the registered bank account of the farmer
To ensure financial transparency and eradicate commission delays under e-NAM, payment settlement is executed digitally. Once electronic bidding and trade transactions settle, funds transfer directly from the buyer into the registered bank account of the farmer via integrated online banking portals. This direct electronic transfer removes middleman cash handling and guarantees prompt payments to growers.

44. (B) Extraction → Clarification → Crystallization → Centrifugation
Industrial processing of sugarcane into white crystal sugar follows a strict sequence. Sugarcane stalks undergo mechanical extraction to obtain raw juice. The juice is processed through clarification to remove impurities. Concentrated juice undergoes controlled evaporation and crystallization to form sugar crystals, followed by centrifugation to separate commercial white sugar crystals from residual molasses liquid.

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54. (D) Cabinet Committee on Economic Affairs (CCEA) chaired by the Prime Minister of India
The Fair and Remunerative Price for sugarcane is formally approved and announced by the Cabinet Committee on Economic Affairs, chaired by the Prime Minister. While recommendations are prepared by the Commission for Agricultural Costs and Prices following detailed consultations, the final statutory approval rests with the CCEA to ensure economic policy alignment across sugar processing sectors.

55. (C) I and III only
AGMARK is a statutory quality certification stamp implemented by the Directorate of Marketing and Inspection, signifying that agricultural products conform to standardized quality norms. Obtaining AGMARK certification is voluntary for farmers selling raw food grains in primary APMC mandis. It applies predominantly to processed, graded, or consumer-packaged agricultural commodities entering specialized retail distribution.

56. (C) Disseminating daily market arrivals and wholesale prices of various agricultural commodities
The Agmarknet portal functions as an information technology initiative designed to capture and disseminate real-time market information across India. It aggregates daily commodity arrivals, wholesale price trends, and trading volumes from thousands of regulated agricultural markets. Access to transparent digital price data protects farmers from market exploitation, aiding timely decision-making regarding produce dispatches.

57. (D) Commission Agent (Adhatiya)
A commission agent, locally referred to as an adhatiya, acts as a functional facilitator in agricultural trade without taking legal title or physical ownership of goods. Commission agents negotiate transactions between primary sellers and commercial buyers, providing marketing assistance, storage, and transaction execution. They earn a specified statutory commission percentage on sales rather than retaining product margins.

58. (A) Form utility
Processing primary agricultural commodities into secondary processed goods creates form utility. Converting perishable raw items, such as fresh mangoes into pickles or sugarcane into jaggery, alters their physical state and chemical form. This transformation increases product shelf life, enhances commercial economic value, and fulfills consumer demand for preserved or value-added food products throughout the year.

59. (B) Extra payment for early-maturing cane varieties yielding higher sugar recovery
In sugarcane marketing, premium pricing represents an additional monetary incentive paid to farmers delivering early-maturing cane varieties. Early-maturing varieties possess higher sucrose density and yield superior sugar recovery rates during the initial crushing phase. Sugar mills provide premium payments to motivate growers to cultivate superior cane varieties, directly enhancing operational processing efficiency and sugar output.

60. (B) Certifying its specific geographical origin and associated unique quality traits
A Geographical Indication tag acts as an official intellectual property right certifying that a product originates from a specific geographic territory and possesses distinctive qualities attributable to that origin. By establishing origin authenticity and unique attributes, GI tags build market trust, prevent unauthorized duplication, and enable farmers to command premium pricing in national and international trade.

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61. (A) Total Production - (Family Consumption + Seed + Feed + Kind Payments + Wastage)
Marketable surplus represents the theoretical residual output left with a farmer after subtracting essential farm-level retentions from gross production. These retentions include household consumption, seed requirements for future planting, animal feed, labor payments made in kind, and post-harvest wastage. It establishes the actual quantity available for sale without compromising the household's farm requirements.

62. (C) Selling price minus buying price and incurred marketing costs
In agricultural economics, the marketing margin of an intermediary represents the gross return earned for executing trade services. It is calculated mathematically by taking the difference between the selling price and buying price, and then subtracting all incurred operational marketing expenses like transit and storage. This net figure reflects the middleman's economic profit.

8. Select the correct sequence of the following indigenous cattle breeds based on their primary utility (Milch → Dual Purpose → Draft):
(A) Sahiwal → Haryana → Amritmahal
(B) Haryana → Gir → Khillari
(C) Tharparkar → Sahiwal → Nagori
(D) Gir → Amritmahal → Tharparkar

9. Which indigenous cattle breed is known as 'White Sindhi' and is highly valued for its dual-purpose nature and excellent disease resistance in arid regions?
(A) Kankrej
(B) Tharparkar
(C) Rathi
(D) Deoni

10. Under the Information Network for Animal Productivity and Health (INAPH) and Pashu Sanjeevani initiatives, how many digits are present in the unique identification (UID) polyurethane ear tag applied to animals?
(A) 10 digits
(B) 12 digits
(C) 14 digits
(D) 16 digits

11. Consider the following statements regarding the Murrah breed of buffalo:
I. It is native to the Rohtak, Hisar, and Jind districts of Haryana.
II. It is characterized by tightly curled, short horns.
III. Its average milk fat percentage is the highest among all buffalo breeds in India.
Which of the above statements is/are correct?
(A) I and II only
(B) II and III only
(C) I and III only
(D) I, II, and III

12. The Central Institute for Research on Goats (CIRG) is located in which district of Uttar Pradesh?
(A) Mathura
(B) Bareilly
(C) Jhansi
(D) Karnal

13. Which of the following is a recognized breed of pig known for its excellent bacon quality, large white body, and erect ears?
(A) Tamworth
(B) Large White Yorkshire
(C) Landrace
(D) Hampshire

14. What is the recommended temperature for preserving cattle semen in liquid nitrogen for Artificial Insemination (AI) purposes?
(A) -40°C
(B) -79°C
(C) -150°C
(D) -196°C

15. The 'Nand Baba Milk Mission' was launched by the Uttar Pradesh Government primarily to:
(A) Enable milk producers to sell milk at remunerative prices in villages via dairy cooperatives.
(B) Eradicate Foot and Mouth Disease and other contagious viral infections in rural dairy clusters.
(C) Import high-yielding exotic cattle breeds to completely replace non-descript indigenous stocks.
(D) Provide free high-quality green and dry fodder to all registered cattle throughout the state.

16. Match the Cattle Breeds in List I with their Distinctive Features/Origins in List II.
List I: (Cattle Breed)
P. Gir
Q. Sahiwal
R. Holstein Friesian
S. Tharparkar
List II: (Distinctive Feature/Origin)
1. Broad convex forehead and half-moon shaped horns
2. Originates from the Montgomery district, known as Lola
3. Deep body, light grey to white colour, arid region adaptability
4. Highest milk yield globally, black and white patches
(A) P-1, Q-2, R-4, S-3
(B) P-2, Q-1, R-4, S-3
(C) P-1, Q-2, R-3, S-4
(D) P-2, Q-1, R-3, S-4

17. Which local cattle breed of Uttar Pradesh is primarily found in the Varanasi and Ghazipur districts and is highly suitable for the climatic conditions of the eastern UP plains?
(A) Kenkatha
(B) Ponwar
(C) Kherigarh

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72. (C) PCF (Pradeshik Cooperative Federation)
Pradeshik Cooperative Federation is the apex cooperative marketing organization in Uttar Pradesh, established to support agricultural producers. PCF facilitates the distribution of agricultural inputs like fertilizers, seeds, and agrochemicals, while actively engaging in state-level price support procurement of food grains like wheat and paddy on behalf of government agencies to guarantee fair market returns.

73. (D) Red Rot
Red Rot, caused by the fungal pathogen Colletotrichum falcatum, is a destructive disease affecting sugarcane crops. The infection causes internal tissue reddening and triggers rapid enzymatic inversion of non-reducing sucrose into reducing sugars like glucose and fructose. This inversion drastically reduces sugar recovery rates during processing, destroying milling potential and commercial value.

74. (A) Supply chain focuses on efficient movement of produce; value chain focuses on adding value through processing and branding.
An agricultural supply chain emphasizes physical logistics, focusing on moving commodities efficiently from producer to consumer. In contrast, an agricultural value chain focuses on adding economic value at each operational node. Through activities like grading, processing, packaging, quality control, and strategic branding, value chain actors enhance market appeal, transforming raw produce into higher-margin commercial products.

75. (B) NPCI (National Payments Corporation of India)
The BHIM Unified Payments Interface system was developed by the National Payments Corporation of India, an initiative of the Reserve Bank of India and Indian Banks' Association. Integrated into the e-NAM platform, UPI enables instant, secure, real-time digital fund transfers between commodity buyers and farmers, facilitating direct online trade settlements without cash management issues.

76. (B) Weather forecasts, market prices, and crop protection advice
The Kisan Suvidha mobile application was launched by the Ministry of Agriculture to provide essential farming and market updates directly to farmers' smartphones. The application delivers customized information regarding local weather forecasts, prevailing mandi prices across nearby markets, plant protection measures, and expert agricultural advisories, helping growers make informed decisions about harvesting and selling produce.

77. (A) Prior to the start of the crop sowing season
The Government of India announces Minimum Support Prices prior to the commencement of the crop sowing season for both Kharif and Rabi crops. Announcing support prices in advance provides clear market economic signals to farmers, guiding crop planning decisions, reducing future price uncertainty, and encouraging higher capital investment in recommended crops.

78. (C) Open transparent auction among competing buyers
In a regulated APMC market yard, agricultural produce is auctioned through an open and transparent bidding process among registered buyers. Open transparent auctions eliminate non-transparent practices like secret hand-sign bidding under cloth covers. Bidders compete publicly, promoting competitive price discovery based on real-time market supply and demand conditions, thereby securing optimal prices for selling farmers.

79. (D) Enabling credit against stored produce to avoid distress sales during low prices
Negotiable Warehouse Receipts and pledge financing systems allow farmers to deposit harvested commodities into accredited warehouses and secure short-term credit using the receipt as collateral. Access to low-cost pledged credit provides immediate liquidity to cover living and farming expenses, enabling producers to hold their crop until market prices recover rather than engaging in immediate distress sales.

80. (C) Cane Development Commission
In Uttar Pradesh, a statutory cane commission or fee is collected from sugar mills on sugarcane purchases under state regulation. Revenue generated from this levy is earmarked for funding the Cane Development Council and local infrastructure projects. The funds finance road construction, link transport networks, irrigation maintenance, and cane development activities within reserved factory areas.

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45. (A) Joint teams of local Cane Cooperative Society and state Cane Department staff
To prevent fraudulent weighment practices during sugarcane procurement in Uttar Pradesh, joint monitoring teams are deployed across purchasing centers and mill gates. Staffed jointly by representatives from local Cane Cooperative Societies and officials from the State Cane Department, these teams verify digital weighbridges, audit measurement records, and protect farmers against arbitrary weight deductions.

46. (A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
Cold-chain infrastructure plays an essential role in marketing perishable horticultural crops such as tomatoes and apples. Maintaining controlled low temperatures drastically reduces metabolic respiration rates, slows tissue degradation, and suppresses microbial growth. This physiological retardation preserves freshness, extends post-harvest shelf life, and significantly reduces quantitative transit losses, directly explaining why cold chains are vital.

47. (D) Place utility
Transporting agricultural commodities from surplus production zones to deficit consumer areas creates place utility. Agricultural crops are often concentrated in specific regional geographic zones, whereas consumption demand is spread nationwide. Freight logistics shift produce across space, balancing regional supply disparities, establishing price equilibrium, and increasing the overall economic value of goods by delivering them where demand is higher.

48. (B) I, II, and IV
The Minimum Support Price policy aims to protect agricultural growers against severe price crashes during heavy harvest seasons. Assuring remunerative rates creates price stability, encouraging farmers to adopt modern techniques and increase overall crop productivity. The policy focuses on farmer welfare and national food security rather than maximizing the profit margins of private wholesale traders.

49. (B) Direct marketing channels linking agricultural farmers straight to final consumers
Institutions like Apni Mandi in Punjab and Rythu Bazar in Andhra Pradesh represent direct marketing frameworks created by state governments. These localized farmers' markets enable agricultural producers to bypass commission agents and wholesale middlemen, selling fruits and vegetables straight to urban consumers. This direct relationship reduces price spreads, securing higher net incomes for farmers and reasonable prices for buyers.

50. (D) Brix and Pol (Sucrose) percentage
Commercial Cane Sugar percentage measures the recoverable sucrose content in harvested sugarcane. Its mathematical determination relies on two key laboratory analytical parameters of extracted cane juice: Brix, which represents total soluble solids, and Pol, which measures optical rotation indicating precise sucrose concentration. Higher Pol and optimal Brix yield superior CCS values and overall milling pricing.

51. (A) P-3, Q-2, R-1, S-4
Commission for Agricultural Costs and Prices recommends Minimum Support Prices for mandated crops. Food Corporation of India manages state procurement, storage, and nationwide public distribution of food grains. Small Farmers Agribusiness Consortium acts as the nodal agency for e-NAM implementation and FPO promotion. National Cooperative Development Corporation plans and finances promotional programs across cooperative sectors nationwide.

52. (A) 1800-180-1551
The Ministry of Agriculture launched the Kisan Call Centre scheme in January 2004 to answer farmers' queries in local languages. Operating through the toll-free number 1800-180-1551 across the country, agricultural experts provide instant advisories regarding crop cultivation practices, pest management, weather forecasts, and real-time market prices, empowering growers with timely scientific information.

53. (A) Post-harvest crop sale at low prices due to urgent cash needs and storage shortage
Distress sale refers to a situation where small and marginal farmers are compelled to sell their crop harvest immediately at un-remunerative prices. Pressed by urgent cash liabilities, debt repayments, and a lack of local scientific storage facilities, growers cannot hold produce for future price improvements, leaving them vulnerable to selling at depressed open market rates.

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CHAPTER 27
Animal Breeds and Identification

1. Which of the following indigenous cattle breeds is widely recognized as the highest milk producer and is characterized by a heavy body, reddish dun colour, and a loose, pendulous skin?
(A) Gir
(B) Tharparkar
(C) Red Sindhi
(D) Sahiwal

2. The Bhadawari breed of buffalo, predominantly found in the Agra and Etawah districts of Uttar Pradesh, is highly valued commercially for which of the following characteristics?
(A) Highest total milk yield per lactation
(B) Extremely large body size and draft capability
(C) Highest milk fat percentage ranging from 8 to 13 percent
(D) High resistance to foot and mouth disease

3. What is the standard physical method used to determine the exact age of cattle and buffaloes in field conditions?
(A) Examining the overall length, skin texture, and thickness of the tail
(B) Eruption and wear of permanent incisors
(C) Counting the visible rings present around the base of the horns
(D) Measuring the total heart girth and body length using a tape

4. In the context of foreign cattle breeds, what is the primary advantage of rearing a Jersey cow over a Holstein Friesian (HF) cow in the agro-climatic conditions of Uttar Pradesh?
(A) Jersey cows produce a significantly higher total volume of milk per lactation than HF cows.
(B) Jersey cows have a completely disease-free genetic lineage across all generations.
(C) Jersey cows are primarily utilized as excellent heavy draft animals in farming.
(D) Better heat tolerance and higher milk fat percentage than HF cows.

5. The National Livestock Mission primarily focuses on which of the following broad objectives?
(A) Sustainable development of the livestock sector, breed improvement, and risk management.
(B) Exclusively eradicating common viral and bacterial diseases across all commercial poultry farms.
(C) Providing free hybrid seeds, agrochemicals, and equipment for agricultural crop production.
(D) Restricting the crossbreeding of indigenous cattle with exotic breeds across all farming regions.

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6. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): Crossbreeding of indigenous cows with Holstein Friesian bulls is generally restricted to maintaining exotic inheritance at 50 to 62.5 percent.
Reason (R): Crossbreds with exotic inheritance higher than 62.5 percent show a marked decline in heat tolerance and disease resistance under Indian climatic conditions.
(A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
(B) Both Assertion (A) and Reason (R) are true but R is not the correct explanation of A.
(C) Assertion (A) is true but Reason (R) is false.
(D) Assertion (A) is false but Reason (R) is true.

7. The Jamunapari breed is an iconic goat breed of Uttar Pradesh. Which of the following is its most distinct physical identifier?
(A) Roman nose and long pendulous ears
(B) Sickle-shaped flat horns along with a pure jet-black coat
(C) Small compact body size suited exclusively for zero-grazing stall feeding
(D) Coarse carpet wool production specifically on the hindquarters

63. (D) A Market Committee representing farmers, traders, and state government officials
Under the statutory APMC system, day-to-day operations and dispute management within market yards are overseen by an elected or nominated Market Committee. This committee includes elected farmer representatives, registered trader delegates, and state government officials. This multi-stakeholder governance model enforces fair trading practices, ensures accurate weighments, resolves contractual disputes, and maintains transparent open bidding processes.

64. (C) Market transactions are governed by statutory rules and standardized weights
A regulated market in agriculture is a physical market center operated under statutory state legislation. Trading activities within these mandis follow standardized rules designed to eliminate market malpractices. They mandate licensed market functionaries, open auction procedures, standardized weights and measures, fixed maximum commission rates, and official oversight committees to safeguard farmers against arbitrary deductions.

65. (B) Direct marketing between agricultural farmers and bulk buyers or consumers
Specialized Kisan Mandis established by the Uttar Pradesh Government serve as direct trade platforms operating alongside conventional APMC yards. These mandis aim to reduce marketing channels by connecting agricultural producers directly with bulk buyers, retail chains, processing industries, and consumers. Direct trade bypasses intermediary commission agents, reducing marketing fees and improving farm realizations.

66. (D) Scientific storage capacity and rural godowns
The Agricultural Marketing Infrastructure sub-scheme, functioning under the Integrated Scheme for Agricultural Marketing, provides capital credit-linked subsidies to create post-harvest infrastructure. Financial assistance focuses on establishing scientific storage facilities, rural godowns, cold storage units, and primary processing infrastructure to prevent distress sales and reduce post-harvest losses among agricultural producers nationwide.

67. (A) Transportation and cold storage facilities
Operation Greens was launched by the Ministry of Food Processing Industries to stabilize supply and market prices for tomato, onion, and potato crops. The scheme provides a 50 percent subsidy on freight transport costs and cold storage rentals during seasonal harvest gluts. This support prevents distress sales and mitigates price volatility across primary producing hubs.

68. (C) 300
According to standard operational guidelines issued by the Small Farmers Agribusiness Consortium for central sector schemes, a Farmer Producer Organization operating in plain regions must mobilize a minimum membership of 300 primary farmers. In hilly and North-Eastern regions, the minimum threshold is adjusted to 100 members to account for low population density.

69. (A) International food standards, codes of practice, and safety guidelines
Codex Alimentarius is a collection of internationally recognized food standards, codes of practice, and safety guidelines established jointly by FAO and WHO. It creates harmonized international standards to protect consumer health and facilitate fair practice in global food trade. These benchmarks resolve non-tariff technical barriers and align quality parameters in international food markets.

70. (D) Price Spread
Price spread represents the total financial difference between the price per unit paid by the ultimate retail consumer and the net price received by the primary agricultural producer. This spread accounts for accumulated costs across all marketing functions, including transport, grading, storage, and processing, along with profit margins retained by intermediate traders along the channel.

71. (B) Ethylene
In Controlled Atmosphere storage systems used for extending the commercial shelf life of climacteric fruits, ethylene gas concentrations are closely regulated and scrubbed. Ethylene acts as a natural gaseous plant hormone that triggers and accelerates fruit ripening. Controlling ethylene alongside oxygen and carbon dioxide levels retards ripening, preserving freshness and extending product marketability.

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(D) Gangatiri

18. The term 'Chevon' refers to the meat of which of the following animals?
(A) Sheep
(B) Pig
(C) Goat
(D) Buffalo

19. The Rashtriya Gokul Mission was launched with which of the following fundamental objectives?
(A) To promote the exclusive rearing of foreign dairy breeds such as Jersey and Holstein Friesian.
(B) Conserve and develop indigenous bovine breeds scientifically.
(C) To establish modernized mega slaughterhouses for old and unproductive cattle across states.
(D) To shift the rural economy entirely from small-scale dairy farming to meat production.

20. Which goat breed is popularly known as the 'Milk Queen' of the goat world due to its exceptionally high milk yield?
(A) Alpine
(B) Toggenburg
(C) Anglo-Nubian
(D) Saanen

21. Consider the following statements regarding the Livestock Census in India:
I. The Livestock Census is conducted across the country every 5 years.
II. The first Livestock Census was conducted in the year 1919-1920.
III. According to the 20th Livestock Census, Uttar Pradesh ranks first in the total buffalo population.
IV. Breed-wise data collection was permanently discontinued in the 20th Livestock Census.
Which of the above statements is/are correct?
(A) I, II, and III
(B) II, III, and IV
(C) I, III, and IV
(D) I, II, and IV

22. In the selection of an elite dairy cow, a 'wedge-shaped' body conformation generally indicates:
(A) Poor overall milk production capability combined with heavy draft utility
(B) Increased susceptibility to metabolic and severe nutritional deficiencies
(C) High milk yield potential and dairy temperament
(D) Purebred genetic lineage derived directly from an exotic dairy breed

23. What is the primary advantage of Artificial Insemination (AI) over natural service in a dairy herd?
(A) Extensive use of superior, progeny-tested sires and prevention of venereal disease spread.
(B) It guarantees a 100 percent conception rate on the very first artificial insemination attempt.
(C) It completely eliminates the operational need for maintaining detailed herd estrus records.
(D) It significantly reduces the standard natural gestation period of the impregnated cow.

24. Which local sheep breed of Uttar Pradesh is known for producing both coarse carpet wool and meat, and is predominantly found in the Jalaun, Jhansi, and Lalitpur districts?
(A) Chokla
(B) Muzaffarnagari
(C) Nali
(D) Jalauni

25. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): The ear tag applied to animals under the national animal identification system is placed in the center of the ear cartilage.
Reason (R): The central cartilage of the ear contains major blood vessels that help in real-time genetic tracking of the animal.
(A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
(B) Both Assertion (A) and Reason (R) are true but R is not the correct explanation of A.
(C) Assertion (A) is true but Reason (R) is false.
(D) Assertion (A) is false but Reason (R) is true.

26. Which of the following indigenous draft breeds of cattle originates from the Pilibhit district of Uttar Pradesh and is known for its narrow face, active nature, and prominent white patches on the body?
(A) Kenkatha
(B) Nimari
(C) Ponwar
(D) Siri

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III. The milk production of a cow is influenced by both its genetic makeup and environmental factors like nutrition and management.

Which of the above statements is/are correct?
(A) I and II only
(B) II and III only
(C) I and III only
(D) I, II, and III

63. The term 'Heterosis' or 'Hybrid Vigor' in livestock crossbreeding refers to:
(A) Crossbred offspring exhibiting superior performance traits over purebred parent averages.
(B) The sudden spontaneous appearance of a lethal genetic mutation across all successive offspring.
(C) The progressive process of an exotic breed completely losing its genetic milk-producing capability over three generations.
(D) The deliberate surgical or physical castration of young male calves specifically to maximize heavy draft capability.

64. A farmer in Uttar Pradesh wants to raise a goat breed primarily for milk production to sell in the local market. Which indigenous breed is most suitable for this purpose, given it is native to the region and known as a good milker?
(A) Black Bengal
(B) Ganjam
(C) Jamunapari
(D) Osmanabadi

65. The primary purpose of using 'Teaser Bulls' in a modern dairy farm is:
(A) To provide direct natural breeding service to elite high-yielding cows.
(B) To pull agricultural field equipment and transport heavy farm machinery.
(C) To aggressively defend and protect the entire grazing herd from wild predators.
(D) Accurate detection of estrus (heat) in cows and heifers.

66. Consider the following statements regarding the Animal Identification System (Tagging):
I. Polyurethane tags are preferred because they are tamper-proof and long-lasting.
II. Tagging is an essential prerequisite for insuring a farm animal under the Livestock Insurance Scheme.
III. The primary disadvantage of tagging is that it fundamentally alters the genetic DNA of the animal.

Which of the above statement(s) is/are incorrect?
(A) I only
(B) II only
(C) III only
(D) I and II only

67. Which of the following is considered the best indigenous draught cattle breed of India, known for its sheer speed, power, and agility in agricultural work?
(A) Sahiwal
(B) Amritmahal
(C) Red Sindhi
(D) Gir

68. Match the Terminology in List I with its Correct Definition in List II.

List I: (Terminology)
P. Sire
Q. Dam
R. Pedigree
S. Progeny

List II: (Definition)
1. The female parent of an animal
2. The offspring of an animal
3. The male parent of an animal
4. The recorded ancestry or lineage of an animal

(A) P-3, Q-1, R-4, S-2
(B) P-1, Q-3, R-2, S-4
(C) P-3, Q-1, R-2, S-4
(D) P-4, Q-2, R-3, S-1

69. A severe nutritional deficiency of Calcium and Phosphorus in lactating dairy cows typically leads to:
(A) Osteomalacia
(B) Foot and Mouth Disease outbreak
(C) Acute systemic anthrax infection
(D) Viral rabies encephalopathy

70. When participating in an animal exhibition (Pashu Mela), judges typically evaluate the 'True Type' or 'Breed Character' of an animal. This assessment heavily relies on:
(A) The exact measured quantity of commercial concentrate feed that the animal consumed early that morning.
(B) The documented socio-economic status, financial standing, and agricultural landholding of the exhibiting farmer.
(C) Breed-specific phenotypic traits like coat colour, horn shape, and body conformation.

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dairy cattle.
(D) They are highly urbanized industrial dairies designed primarily to produce processed synthetic milk.

36. Among indigenous cattle breeds, which one is widely considered the best dual-purpose breed in India, known for good milk yield and excellent draft capacity of bullocks?
(A) Kankrej
(B) Sahiwal
(C) Malvi
(D) Haryana

37. Progeny testing is a critical component of livestock genetic improvement programs. What does it primarily evaluate?
(A) Genetic worth of a sire based on offspring performance.
(B) The exact metabolic and nutritional requirements of a newly born dairy calf.
(C) The overall physical health, body score, and vaccination status of the dam.
(D) The overall nutritional quality and intake of feed consumed by the entire herd.

38. The Livestock Insurance Scheme is designed to provide protection to farmers against:
(A) Unpredictable seasonal fluctuations in the wholesale market price of milk.
(B) The total capital cost of constructing permanent concrete animal housing sheds.
(C) Animal loss due to disease, accidents, or natural calamities.
(D) Theft, spoilage, or burglary of processed dairy products from farms.

39. Consider the following statements regarding the physical and genetic basis of animal identification:
I. Tagging, branding, and tattooing are physical methods of animal identification.
II. DNA profiling using microsatellite markers provides a definitive genetic basis for establishing parentage and breed purity.
III. Hot iron branding is generally recommended for identifying high-yielding exotic breeds because it is painless.
IV. The muzzle print of cattle is unique to each individual, much like a human fingerprint.
Which of the above statements is/are correct?
(A) I, II, and IV
(B) I, II, and III
(C) II, III, and IV
(D) I, III, and IV

40. Under standard agricultural practice, which implement or tool is commonly used to accurately and permanently mark the ears of pigs for identification?
(A) Hot iron branding tool
(B) Neck chain numbering system
(C) Paint stick
(D) Ear notching plier

41. The Kenkatha cattle breed is a draft-purpose breed native to Uttar Pradesh. It is primarily found along the banks of which river?
(A) Ganga
(B) Ken
(C) Yamuna
(D) Gomti

42. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): Maintaining accurate farm records is significantly simplified by the implementation of the 12-digit UID tagging system.
Reason (R): The UID tag connects the individual animal to a centralized digital database like INAPH, allowing instant retrieval of its vaccination, breeding, and health history.
(A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
(B) Both Assertion (A) and Reason (R) are true but R is not the correct explanation of A.
(C) Assertion (A) is true but Reason (R) is false.
(D) Assertion (A) is false but Reason (R) is true.

43. The Muzaffarnagari breed of sheep is native to Western Uttar Pradesh. Which of the following is true about this breed?
(A) It is categorized as the absolute smallest indigenous sheep breed found in India.
(B) It is primarily raised across regions for high-grade fine apparel garment wool.
(C) It is a naturally polled, hornless breed exclusively in both adult males and females.
(D) Large, tall sheep breed used mainly for mutton and coarse wool.

44. What is the standard term for the process of removing the horn-producing tissues in young calves (usually within 7-15 days of birth) to prevent horn growth?
(A) Disbudding
(B) Docking
(C) Castration
(D) Shearing

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9. (B) Tharparkar
Tharparkar cattle originate from the arid Thar desert region and are commonly designated as White Sindhi due to their light grey coat color and close genetic affinity. Highly regarded as an efficient dual-purpose breed, they withstand extreme temperature variations, tropical heat, and drought while producing substantial milk yield and powerful draft bullocks.

10. (B) 12 digits
Under national animal health digital frameworks like INAPH and Pashu Sanjeevani, farm animals are fitted with a non-reusable polyurethane ear tag containing a unique twelve-digit code. This twelve-digit UID number functions as a universal identity token, enabling real-time digital recording of vaccination records, breeding history, disease monitoring, and ownership details across national databases.

11. (A) I and II only
Murrah buffaloes originate from the Rohtak, Hisar, and Jind tracts of Haryana and are distinguished by short, tightly curled spiral horns. While they represent the world's premier milk-producing buffalo breed, their milk fat percentage averages around seven percent, whereas the Bhadawari breed holds the record for highest milk fat percentage in India.

12. (A) Mathura
The Central Institute for Research on Goats is a premier national research institute located at Makhdoom, near Farah in the Mathura district of Uttar Pradesh. Established under the Indian Council of Agricultural Research, it conducts advanced research on goat nutrition, genetic conservation, disease control, processing technologies, and extension activities for smallholder goat farmers.

13. (B) Large White Yorkshire
Large White Yorkshire is an exotic pig breed widely utilized for commercial pork and bacon production. Characterized by its large frame, solid white body, erect ears, and excellent prolificacy, this breed adapts well to intensive farming systems. It is extensively deployed in breed improvement programs to upgrade non-descript indigenous swine populations.

14. (D) -196°C
Ultra-low temperature preservation in liquid nitrogen at minus one hundred ninety-six degrees Celsius halts all cellular metabolic activity in bull spermatozoa. Cryopreserved at this extremely low temperature inside specialized cryogenic containers, frozen semen straws maintain structural viability and fertility for decades, enabling wide geographical distribution and effective genetic dissemination through artificial insemination networks.

15. (A) Enable milk producers to sell milk at remunerative prices in villages via dairy cooperatives.
The Nand Baba Milk Mission was launched by the Uttar Pradesh Government to empower rural milk producers and strengthen cooperative dairy networks. The initiative ensures remunerative prices for village milk producers by establishing village-level dairy cooperative societies, improving cold chain facilities, promoting modern cattle rearing practices, and streamlining marketing channels across the state.

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16. (A) P-1, Q-2, R-4, S-3
Gir cattle feature a distinctive broad convex forehead and half-moon shaped horns. Sahiwal originates from the Montgomery district and is locally called Lola due to its loose skin. Holstein Friesian boasts the highest global milk production with black and white patches. Tharparkar possesses a deep light grey body adapted to arid environments.

17. (D) Gangatiri
Gangatiri is an indigenous dual-purpose cattle breed native to the banks of the river Ganga, primarily reared in the Varanasi, Ghazipur, and Ballia districts of eastern Uttar Pradesh. Well-adapted to the hot, humid alluvial plains, these cows produce moderate quantities of milk while bullocks exhibit exceptional draft capability for agricultural operations.

18. (C) Goat
Chevon is the standard livestock and commercial culinary term used globally to denote meat derived from adult goats. Distinct from mutton, which specifically designates adult sheep meat, chevon is highly valued across domestic and international markets for its lean nutritional profile, lower saturated fat content, high digestibility, and rich protein concentration.

54. The 'Nakul Swasthya Patra' distributed under the government schemes acts as:
(A) A commercial government license required to sell processed dairy products internationally.
(B) A legal certificate of property ownership used for claiming barren government agricultural land.
(C) Animal health card with ID, vaccination, and breeding records.
(D) An official customs permit designated for transporting livestock across international state borders.

55. Which of the following physical characteristics helps distinguish the exotic Jersey cattle breed from the Holstein Friesian breed?
(A) Reddish-fawn coat and smaller body frame than the black-and-white HF.
(B) Jersey is uniformly jet-black and white, whereas HF is completely deep reddish-brown throughout.
(C) Jersey exhibits an extraordinarily massive body frame, whereas HF is the smallest dairy breed known.
(D) Jersey possesses a prominent thoracic hump, whereas HF is completely hump-less across all lines.

56. Consider the following statements regarding artificial insemination (AI) and crossbreeding:
I. Semen from one superior bull can be used to inseminate thousands of cows annually through AI.
II. Crossbred calves generally show higher birth weights and faster growth rates than non-descript indigenous calves due to heterosis.
III. AI guarantees a 100% cure for all bacterial diseases in the reproductive tract of the cow.
IV. Proper detection of estrus (heat) by the farmer is crucial for the success of AI.
Which of the above statements is/are correct?
(A) I, II, and IV
(B) II, III, and IV
(C) I, III, and IV
(D) I, II, and III

57. The meat of a buffalo is legally and commercially referred to in the export market as:
(A) Mutton
(B) Cara-beef
(C) Beef
(D) Venison

58. A purebred Murrah buffalo is being selected for a high-yield dairy farm. Which characteristic should the farmer identify to confirm its breed purity?
(A) Copper-coloured body and very long sweeping horns
(B) Jet black body with a white patch on the forehead and tightly curled, short horns
(C) Jet black body with no white patches and tightly curled, short horns
(D) Grey body colour with sickle-shaped horns

59. Which exotic breed of pig is characterized by a white body, erect ears, and a typical "dished" (concave) face, and is frequently used in crossbreeding programs in India?
(A) Landrace
(B) Hampshire
(C) Berkshire
(D) Middle White Yorkshire

60. The conservation of indigenous animal breeds in India is crucial for biodiversity because:
(A) They possess heat tolerance, disease resistance, and ability to thrive on poor roughages.
(B) Indigenous breeds consume exclusively commercial concentrate feed, significantly reducing the grazing burden on natural pastures.
(C) Indigenous breeds consistently produce the exact same high milk volume as exotic breeds while requiring virtually zero water.
(D) Indigenous cattle herds are solely and directly responsible for preventing severe soil erosion in agricultural ecosystems.

61. Under standard productivity norms, what is the approximate average lactation milk yield of a well-managed indigenous Sahiwal cow?
(A) 500 - 800 kg
(B) 2000 - 2500 kg
(C) 6000 - 8000 kg
(D) 10000 - 12000 kg

62. Consider the following statements regarding the selection of a dairy animal based on milk production capacity:
I. The pedigree record (dam's and grandam's milk yield) is a highly reliable criterion for selecting a young dairy heifer.
II. An enlarged, pendulous, and heavily meaty udder without distinct milk veins is the best indicator of a high yielder.

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27. The breed improvement crossbreed 'Frieswal' is a result of a cross between:
(A) Brown Swiss bull and Sahiwal cow
(B) Jersey bull and Red Sindhi cow
(C) Holstein Friesian bull and Tharparkar cow
(D) Holstein Friesian bull and Sahiwal cow

28. Consider the following statements regarding the Barbari breed of goat:
I. It is highly suitable for stall-feeding systems.
II. Twin and triplet births are very common in this breed.
III. It is a large-sized breed primarily used for heavy draft purposes.
Which of the above statement(s) is/are incorrect?
(A) I only
(B) II only
(C) III only
(D) I and II only

29. Which scheme was implemented in Uttar Pradesh to provide financial assistance of ₹50 per day per cattle (increased from ₹30) to farmers and cattle-rearers for maintaining stray, destitute cattle (govansh)?
(A) Mukhyamantri Pashu Swasthya Yojana
(B) Mukhyamantri Nirashrit Besahara Govansh Sahbhagita Yojana
(C) Pandit Deendayal Upadhyaya Pashupalan Yojana
(D) Kamdhenu Dairy Yojana

30. What is the standard scientific term used for the act of giving birth in pigs?
(A) Calving
(B) Farrowing
(C) Kidding
(D) Whelping

31. Arrange the following fundamental steps of Artificial Insemination (AI) using the recto-vaginal method in the correct procedural order:
I. Passing the AI gun gently through the cervix.
II. Thawing the semen straw in warm water.
III. Loading the thawed semen straw into the AI gun.
IV. Restraining the animal securely in a Travis/ Crush.
(A) IV, II, III, I
(B) II, IV, I, III
(C) IV, III, II, I
(D) II, III, IV, I

32. Animal exhibitions and livestock melas are organized by the government primarily to:
(A) Force rural dairy farmers to sell off their indigenous cattle to commercial herds.
(B) Register all unrecorded animals directly into state-operated national slaughterhouses.
(C) Assess breed quality, build awareness, and foster competition.
(D) Distribute imported synthetic milk substitutes and chemical supplements to dairy farmers.

33. The Nili-Ravi breed of buffalo is physically easily identified by which of the following distinct characteristics?
(A) Sickle-shaped flat horns combined with a distinct copper-coloured coat body.
(B) Extremely long, backward-curving massive horns reaching back to the shoulders.
(C) Pure white coat colour uniformly distributed throughout the entire animal body.
(D) White markings on forehead, face, muzzle, legs, and tail switch.

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34. Match the Institutes in List I with their Headquarters in List II.
List I: (Institute)
P. National Dairy Research Institute (NDRI)
Q. Central Institute for Research on Goats (CIRG)
R. Indian Grassland and Fodder Research Institute (IGFRI)
S. Central Avian Research Institute (CARI)
List II: (Headquarters)
1. Makhdoom, Mathura
2. Karnal, Haryana
3. Izatnagar, Bareilly
4. Jhansi, Uttar Pradesh
(A) P-2, Q-1, R-4, S-3
(B) P-2, Q-4, R-1, S-3
(C) P-1, Q-2, R-3, S-4
(D) P-3, Q-1, R-4, S-2

35. 'Gokul Grams' are being established under the Rashtriya Gokul Mission. What is their primary function?
(A) They are designated governmental isolation areas established solely for quarantining diseased animals.
(B) Integrated indigenous cattle development centres for conservation and breed improvement.
(C) They are specialized livestock trade markets established for trading exclusively in exotic

(D) Only the gross overall body weight of the animal measured on scales irrespective of structural proportions.

71. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): Goat milk is naturally homogenized and is easier for human infants and invalids to digest compared to cow milk.
Reason (R): The fat globules in goat milk are significantly smaller in size and lack the agglutinin protein that causes fat clustering.
(A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
(B) Both Assertion (A) and Reason (R) are true but R is not the correct explanation of A.
(C) Assertion (A) is true but Reason (R) is false.
(D) Assertion (A) is false but Reason (R) is true.

72. Which of the following indigenous cattle breeds is prominently identified by its large, pendulous, leaf-like ears and a prominent, convex forehead?
(A) Tharparkar
(B) Kherigarh
(C) Malvi
(D) Gir

73. The 'Bharat Pashudhan' portal, an upgraded database system of the Government of India, is utilized primarily for:
(A) Tracking global market fluctuations and international agricultural commodity prices.
(B) Registering tagging, vaccination, AI, and health records.
(C) Distributing state subsidies for major machinery and heavy tractor purchases.
(D) Monitoring seasonal water levels and flow rates across agricultural canals.

74. Which of the following crossbred cattle strains was developed by crossing Holstein Friesian with the Tharparkar breed at NDRI?
(A) Karan Swiss
(B) Frieswal
(C) Karan Fries
(D) Sunandini

75. The health of a dairy animal is directly correlated with breed quality expression. A cow heavily infested with internal parasites (worms) will most likely exhibit:
(A) A rapid, exponential increase in overall milk fat percentage and solid-not-fat content.
(B) Complete systemic immunity against major viral diseases like Foot and Mouth Disease.
(C) A distinct, permanent structural change in its natural breed-specific coat colour.
(D) Rough coat, stunted growth, and failure to reach genetic milk potential.

76. In an organized dairy farm, record keeping is crucial. Which specific record will a farmer check to predict the expected calving date of a pregnant cow?
(A) Service register
(B) Daily milk production register
(C) Calf mortality and health register
(D) Daily feed consumption register

77. The Jaffarabadi buffalo is a heavy breed native to the Gir forests of Gujarat. It is easily distinguishable by its:
(A) Symmetrically aligned, flat, sickle-shaped horns extending laterally
(B) Broad horns curving downward then upward at tips
(C) Tightly curled, short, spiral-like horns situated close to the head
(D) Complete natural polled condition and total absence of horns in both sexes

78. Which of the following indigenous goat breeds is primarily reared for the production of 'Pashmina' wool?
(A) Barbari
(B) Changthangi
(C) Sirohi
(D) Osmanabadi

79. The 'Kherigarh' cattle breed is a draft breed native to the Terai region of which state?
(A) Uttar Pradesh
(B) Rajasthan
(C) Gujarat
(D) Haryana

80. Identify the incorrect statement from the following regarding the animal insurance schemes operating in Uttar Pradesh:
(A) The scheme protects cattle owners from financial ruin in case of the sudden death of their milch animals.
(B) The application of an identification tag is mandatory before an animal can be insured.
(C) Subsidies on the insurance premium are strictly reserved only for large corporate dairy farms.

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(D) A veterinary doctor must issue a health and valuation certificate for the animal prior to insurance processing.

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ANSWERS

1. (D) Sahiwal
Sahiwal is an elite indigenous dairy cattle breed originating from the Montgomery region of undivided Punjab. It is renowned across India as the highest milk producer among zebu cattle. Characterized by a heavy body frame, loose pendulous skin, reddish-dun coat color, and symmetrical udders, this breed displays remarkable heat tolerance and resistance to common tropical diseases.

2. (C) Highest milk fat percentage ranging from 8 to 13 percent
The Bhadawari buffalo breed is commercially famous for its ability to convert sparse feed into butterfat-rich milk. Native to the ravines of Uttar Pradesh, its milk contains an exceptionally high fat content ranging between eight and thirteen percent. This high fat yield makes the breed invaluable for ghee production, enabling smallholders to obtain premium market prices.

3. (B) Eruption and wear of permanent incisors
Determining age through dentition is the most accurate physical method in livestock management. Cattle and buffaloes possess temporary milk teeth at birth, which are progressively replaced by four pairs of permanent incisors on the lower jaw between two and five years. Examining the chronological eruption and degree of wear on these incisors provides precise age estimations.

4. (D) Better heat tolerance and higher milk fat percentage than HF cows.
Jersey cattle demonstrate superior physiological adaptation to tropical climates compared to Holstein Friesians. They possess better heat tolerance, lower maintenance feed requirements, and higher resistance to environmental stressors prevailing in Uttar Pradesh. Furthermore, Jersey milk contains a significantly higher fat percentage, making it economically advantageous for local dairy farmers who are compensated based on fat yield.

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5. (A) Sustainable development of the livestock sector, breed improvement, and risk management.
Launched to optimize productivity, the National Livestock Mission focuses on the sustainable development of animal husbandry. Key pillars include genetic improvement of indigenous livestock, enhancement of fodder availability, capacity building, and risk mitigation through animal insurance. The initiative integrates modern technology with traditional farming systems to elevate farmer incomes and enhance feed security across rural agricultural zones.

6. (A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
In tropical breeding policies, exotic inheritance levels are capped between fifty and sixty-two point five percent. Beyond this threshold, crossbred animals suffer severe physiological stress under high humidity and temperatures, while their natural disease resistance diminishes sharply. Consequently, maintaining this optimal genetic balance provides high milk potential without compromising heat tolerance or survival in local environments.

7. (A) Roman nose and long pendulous ears
The Jamunapari goat, native to the Chambal ravines of Uttar Pradesh, is a flagship dual-purpose breed recognized for milk and meat. Its hallmark anatomical features include a prominent convex facial line termed a Roman nose, along with remarkably long, flat, pendulous ears. These distinct features easily distinguish it from other indigenous goat breeds.

8. (A) Sahiwal → Haryana → Amritmahal
Indigenous cattle are functionally classified into milch, dual-purpose, and draft categories. Sahiwal represents an elite milch breed producing high lactation yields. Haryana serves as a classic dual-purpose breed, providing capable draft bullocks and good milk yield. Amritmahal is an iconic draft breed known for exceptional stamina, speed, and hardiness in heavy agricultural field operations.

45. Consider the following statements concerning the 'Surti' breed of buffalo:
I. Its native tract is the Kheda and Baroda districts of Gujarat.
II. It possesses characteristic sickle-shaped horns.
III. Prominent white chevrons (V-shaped bands) are present on the brisket and jaw.
Which of the above statements is/are correct?
(A) I and II only
(B) II and III only
(C) I and III only
(D) I, II, and III

46. Under the breed improvement programs, the crossbred cattle 'Karan Swiss' was developed at NDRI by crossing which two breeds?
(A) Holstein Friesian and Sahiwal
(B) Brown Swiss and Sahiwal
(C) Jersey and Tharparkar
(D) Holstein Friesian and Tharparkar

47. Which indigenous sheep breed of India, native to Rajasthan, is often referred to as the "Merino of India" due to its excellent fine carpet wool quality?
(A) Chokla
(B) Nellore
(C) Marwari
(D) Deccani

48. Select the correct sequential path of the milk let-down reflex in a dairy cow after the calf begins suckling:
(A) Suckling stimulus → Hypothalamus → Posterior Pituitary releases Oxytocin → Contraction of myoepithelial cells in udder
(B) Suckling stimulus → Anterior Pituitary releases Prolactin → Hypothalamus → Relaxation of udder sphincter
(C) Suckling stimulus → Thyroid gland → Release of Thyroxine → Contraction of alveoli
(D) Suckling stimulus → Adrenal gland → Release of Adrenaline → Dilation of milk ducts

49. In a dairy herd, evaluating a cow's 'Milk Vein' (Subcutaneous abdominal vein) helps an experienced farmer visually assess:
(A) The exact fat percentage and solid-not-fat (SNF) content in the milk.
(B) The presence of chronic parasitic worms or infections in the digestive tract.
(C) The verified genetic breed purity and ancestral background of the cow.
(D) Blood flow to udder, indicating milk production capacity.

50. The true, glandular stomach of a ruminant animal where enzymatic digestion occurs is called the:
(A) Rumen
(B) Reticulum
(C) Abomasum
(D) Omasum

51. Match the Local Breeds of Uttar Pradesh in List I with their Major Native Districts in List II.
List I: (Local Breed)
P. Gangatiri (Cattle)
Q. Bhadawari (Buffalo)
R. Ponwar (Cattle)
S. Barbari (Goat)
List II: (Major Native District)
1. Pilibhit
2. Agra, Mathura, Etawah
3. Varanasi, Ghazipur
4. Agra, Etawah (ravine areas)
(A) P-3, Q-4, R-1, S-2
(B) P-4, Q-3, R-2, S-1
(C) P-3, Q-2, R-1, S-4
(D) P-1, Q-4, R-3, S-2

52. Which indigenous goat breed of India is primarily famous for producing high-quality meat and highly valuable skin, and is known for extreme prolificacy (often giving birth to triplets or quadruplets)?
(A) Jamunapari
(B) Gaddi
(C) Sirohi
(D) Black Bengal

53. Under the National Livestock Mission (NLM), subsidies and financial assistance are heavily directed towards which of the following areas to improve breed productivity?
(A) Breed multiplication, fodder seed production, and livestock insurance.
(B) Importing synthetic milk substitutes and artificial dairy preservatives.
(C) Promoting the exclusive cultivation of commercial cash crops over fodder crops.
(D) Complete mechanization of rural agricultural land to replace all draft animals.

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19. (B) Conserve and develop indigenous bovine breeds scientifically.
Launched under the National Programme for Bovine Breeding and Dairy Development, the Rashtriya Gokul Mission focuses on the scientific conservation and genetic upgrading of indigenous bovine breeds. The program establishes Gokul Grams, promotes elite bull selection through field progeny testing, enhances artificial insemination coverage, and preserves valuable native gene pools across India.

20. (D) Saanen
Saanen is a renowned dairy goat breed originating from the Saanen valley in Switzerland. Widely acclaimed as the Milk Queen of the goat world, it produces exceptional daily milk volumes over extended lactation periods. Characterized by a white or light cream coat and quiet temperament, it is globally utilized in commercial dairying.

21. (A) I, II, and III
The quinquennial Livestock Census in India began in 1919-1920 to systematically monitor livestock populations. According to the 20th Livestock Census, Uttar Pradesh holds the top position in total buffalo numbers nationwide. Breed-wise data collection was successfully conducted during the 20th census, disproving any assertion of its permanent discontinuation in modern enumeration surveys.

22. (C) High milk yield potential and dairy temperament
In dairy livestock evaluation, a wedge-shaped body conformation signifies high milk yielding capacity and true dairy temperament. The structure exhibits three distinct wedges: viewing from the side (deep hindquarters tapering to the chest), from above (broad hips tapering to the shoulders), and from the front (narrow brisket widening to the barrel).

23. (A) Extensive use of superior, progeny-tested sires and prevention of venereal disease spread.
Artificial Insemination enables widespread genetic dissemination by utilizing frozen semen from outstanding, progeny-tested bulls to impregnate thousands of cows across large regions. Crucially, strict laboratory evaluation and controlled processing of semen eliminate the transmission of contagious venereal infections like trichomoniasis and brucellosis that frequently spread through natural mating in herds.

24. (D) Jalauni
The Jalauni sheep is an indigenous breed native to the Bundelkhand region of Uttar Pradesh, particularly in Jalaun, Jhansi, and Lalitpur districts. Reared under semi-arid grazing management, it serves a dual purpose by yielding coarse carpet wool along with good quality mutton, providing essential livelihood security to small and landless rural farmers.

25. (C) Assertion (A) is true but Reason (R) is false.
Polyurethane ear tags are routinely applied to the central area of ear cartilage to avoid damaging major blood vessels or nerve pathways along the margins. The tag serves purely as a physical identification token linked to a digital database, rather than performing any real-time biological or genetic tracking function in animals.

26. (C) Ponwar
Ponwar is a small, energetic draft cattle breed native to the Pilibhit district of Uttar Pradesh. Characterized by a narrow face, small erect ears, distinct black and white patches, and aggressive demeanor, these bulls are highly active and prized for fast field cultivation and transport work throughout the foot-hill Terai region.

27. (D) Holstein Friesian bull and Sahiwal cow
Frieswal is a high-yielding crossbred cattle strain developed through inter-se mating by crossing Holstein Friesian bulls with indigenous Sahiwal cows. Maintained around fifty-eight percent exotic inheritance, Frieswal successfully combines the high milk yield potential of Holstein Friesian with the heat tolerance and disease resistance of Sahiwal under Indian management conditions.

28. (C) III only
The Barbari goat is a compact, small-sized dual-purpose breed native to urban and semi-urban areas of Uttar Pradesh. Highly valued for zero-grazing stall feeding systems, it displays exceptional prolificacy with frequent twin and triplet births. It is raised strictly for meat and milk production rather than heavy agricultural draft operations.

29. (B) Mukhyamantri Nirashrit Besahara Govansh Sahbhagita Yojana
The Uttar Pradesh Government implemented the Mukhyamantri Nirashrit Besahara Govansh Sahbhagita Yojana to address the issue of stray cattle. Under this social participation scheme,

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70. (C) Breed-specific phenotypic traits like coat colour, horn shape, and body conformation.
In livestock exhibitions and animal breed competitions, judging true type or breed character evaluates how closely an individual animal matches the standardized physical ideal of its breed. Judges systematically assess distinct phenotypic traits including coat color patterns, forehead structure, ear placement, horn shape, hump development, and overall structural body conformation.

71. (A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
Goat milk is naturally homogenized and highly digestible because its fat globules are substantially smaller than those in cow milk. Lacking agglutinin protein, goat fat globules do not cluster together, promoting rapid enzymatic breakdown in the human digestive tract and rendering it ideal for infants, elderly individuals, and convalescent patients.

72. (D) Gir
Gir cattle, originating from the Gir forest region of Gujarat, are prominently recognized by their distinctive facial conformation. They feature a remarkably broad, convex forehead that acts as a shield, paired with long, pendulous, folded ears resembling a curled leaf. These striking physical features distinguish Gir from all other zebu breeds.

73. (B) Registering tagging, vaccination, AI, and health records.
The Bharat Pashudhan portal is an upgraded digital national database established by the Government of India to streamline livestock traceability. Integrating twelve-digit ear tagging numbers, it records real-time data on animal registration, prophylactic vaccinations, artificial inseminations, pregnancy diagnoses, milk recording, and disease surveillance across all states for efficient health management.

74. (C) Karan Fries
Karan Fries is a crossbred dairy cattle strain developed at the National Dairy Research Institute in Karnal. It was created by crossing exotic Holstein Friesian bulls with indigenous Tharparkar cows. Maintained with optimal exotic inheritance, Karan Fries demonstrates high milk production capabilities combined with superior heat tolerance and tropical adaptability.

75. (D) Rough coat, stunted growth, and failure to reach genetic milk potential.
Internal parasitic infestations, such as gastrointestinal worms and liver flukes, severely compromise livestock health and productivity. Parasites consume nutrients, cause intestinal bleeding, and impair metabolic absorption. Affected animals exhibit a dull rough hair coat, stunted growth, anemia, emaciation, poor feed conversion, and a failure to express their true genetic milk yield potential.

76. (A) Service register
The service register on a dairy farm documents essential breeding records including the date of artificial insemination or natural service, bull identification, and heat status. By adding the average gestation period of cattle (approximately two hundred eighty-three days) to the recorded insemination date, farm managers precisely calculate the expected calving date.

77. (B) Broad horns curving downward then upward at tips
The Jaffarabadi buffalo is a massive, heavy breed native to the Gir forest region of Gujarat. It is physically distinguished by a broad, prominent forehead overhang and thick, flat horns that curve downward alongside the neck before turning upward at the tips, creating a striking aesthetic feature unique to this breed.

78. (B) Changthangi
The Changthangi goat, native to the high-altitude Changthang plateau of Ladakh, is world-famous for producing fine Pashmina fiber. Reared by nomadic pastoralists in extreme cold climates, these goats grow a dense, fine undercoat of soft wool beneath their coarse hair to protect against freezing temperatures, yielding highly valuable Cashmere fiber.

79. (A) Uttar Pradesh
Kherigarh is a small, active draft cattle breed native to the Lakhimpur Kheri district located within the swampy Terai region of northern Uttar Pradesh. Characterized by clean white coat coloration, lyre-shaped horns, and energetic temperament, Kherigarh bullocks excel in light plowing and cart transportation across marshy and wet agricultural terrain.

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offers definitive genetic verification of parentage. Muzzle prints are unique to individual bovines, serving as biological identifiers. However, hot iron branding is painful and destroys hide value, making it completely unsuitable and not recommended for high-yielding exotic dairy breeds.

40. (D) Ear notching plier
Ear notching using a specialized ear notching plier is the standard method for permanent identification in swine management. V-shaped notches cut into specific locations on the upper and lower borders of the right and left ears correspond to numeric values, enabling accurate record keeping for litter numbers and individual pig identification.

41. (B) Ken
The Kenkatha cattle breed, also known as Kenwariya, is an indigenous draft breed native to the Bundelkhand region of Uttar Pradesh and Madhya Pradesh. It is specifically distributed along the banks of the Ken River. Small, sturdy, and hardy, these cattle thrive on poor grazing and perform heavy work in rocky terrain.

42. (A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
Tagging individual farm livestock with a twelve-digit ear tag streamlines overall record keeping by assigning a non-duplicable digital identifier to each animal. This unique code links directly to centralized national databases like INAPH, allowing field technicians and veterinarians to log, track, and instantly retrieve breeding, health, and vaccination histories accurately.

43. (D) Large, tall sheep breed used mainly for mutton and coarse wool.
The Muzaffarnagari sheep is recognized as one of the largest and tallest indigenous sheep breeds in India. Native to Western Uttar Pradesh, particularly Muzaffarnagar and surrounding districts, it features a prominent large frame, long legs, and white fleece, primarily valued for mutton production along with producing coarse carpet grade wool.

44. (A) Disbudding
Disbudding is the routine livestock management procedure of destroying horn-producing tissue in young calves, typically performed within the first two weeks of life. Executed using a heated chemical paste or electric cautery iron, disbudding prevents horn development, ensuring herd safety, reducing aggression injuries, and making future animal handling significantly easier.

45. (D) I, II, and III
Surti is a medium-sized buffalo breed native to the Charottar tract of Gujarat, including Kheda and Vadodara districts. Its distinct physical identifiers include characteristic sickle-shaped horns and two prominent white V-shaped hair bands, known as chevrons, located across the brisket and jaw regions. It is well known for producing high butterfat milk.

46. (B) Brown Swiss and Sahiwal
Karan Swiss is a high-yielding crossbred cattle strain developed at the National Dairy Research Institute in Karnal. It was produced by crossbreeding exotic Brown Swiss bulls with high-yielding indigenous Sahiwal cows. The resulting crossbred strain exhibits superior milk yield along with good adaptability and heat tolerance under tropical climatic conditions.

47. (A) Chokla
The Chokla sheep, native to the Shekhawati region of Rajasthan, is often referred to as the Merino of India due to its ability to produce the finest carpet-grade wool among indigenous sheep. Characterized by a dark brown or reddish face and light fleece, it produces high-quality apparel wool when selectively bred.

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48. (A) Suckling stimulus → Hypothalamus → Posterior Pituitary releases Oxytocin → Contraction of myoepithelial cells in udder
The milk ejection reflex involves a neuroendocrine pathway triggered by tactile suckling or udder preparation. Sensory nerves carry impulses to the hypothalamus, stimulating the posterior pituitary gland to release oxytocin into the bloodstream. Oxytocin travels to the mammary gland, forcing contraction of myoepithelial cells surrounding alveoli to squeeze stored milk into teat cisterns.

49. (D) Blood flow to udder, indicating milk production capacity.
The milk vein, scientifically known as the subcutaneous abdominal vein, runs along the belly of high-yielding dairy cows. A prominent, tortuous, and well-developed milk vein indicates heavy blood circulation toward the mammary

CHAPTER 28
Animal Nutrition Management

1. In animal nutrition, what does the term TDN stand for?
(A) Total Dietary Nitrogen
(B) Total Dry Nutrients
(C) True Digestible Nitrogen
(D) Total Digestible Nutrients

2. Which of the following is considered a non-protein nitrogen (NPN) source commonly fed to ruminants to meet their protein requirements?
(A) Fish meal
(B) Soybean meal
(C) Urea
(D) Groundnut cake

3. How much more gross energy does one gram of crude fat provide compared to one gram of carbohydrate in animal feed?
(A) 1.25 times
(B) 1.50 times
(C) 2.25 times
(D) 3.50 times

4. Match the following feed nutrients (List I) with their primary function in the animal body (List II):
List I: (Feed Nutrients)
P. Carbohydrates
Q. Proteins
R. Calcium
S. Vitamin A
List II: (Primary Functions)
1. Tissue growth and repair
2. Vision and epithelial health
3. Immediate energy source
4. Bone and teeth formation
(A) P-3, Q-1, R-4, S-2
(B) P-1, Q-3, R-2, S-4
(C) P-3, Q-4, R-1, S-2
(D) P-4, Q-1, R-3, S-2

5. By definition, a roughage is a feedstuff that contains more than what percentage of crude fiber?
(A) 10 percent
(B) 18 percent
(C) 25 percent
(D) 35 percent

6. In the proximate analysis of feed, Nitrogen Free Extract (NFE) primarily represents which of the following components?
(A) Insoluble structural fiber
(B) Crude protein
(C) Soluble carbohydrates
(D) Volatile fatty acids

7. Consider the following assertion and reason statements:
Assertion (A): Ruminants can utilize urea to synthesize high-quality microbial protein.
Reason (R): The rumen contains a massive population of symbiotic bacteria and protozoa that can incorporate non-protein nitrogen into their own body proteins.
(A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
(B) Both Assertion (A) and Reason (R) are true but R is not the correct explanation of A.
(C) Assertion (A) is true but Reason (R) is false.
(D) Assertion (A) is false but Reason (R) is true.

8. What is the main advantage of feeding bypass protein to high-yielding dairy cows?
(A) It degrades rapidly within the rumen to supply quick microbial nitrogen for bacteria.
(B) It bypasses the large intestine entirely to prevent harmful gas formation in cattle.
(C) It eliminates the need for feeding supplementary dietary carbohydrates to the dairy cow.
(D) It escapes microbial degradation in the rumen to be digested in the abomasum.

9. What is the standard daily dry matter requirement for an adult cow weighing 400 kg?
(A) 4 to 5 kg
(B) 8 to 10 kg
(C) 12 to 15 kg
(D) 20 to 22 kg

10. Which of the following is classified as a macro-mineral in animal nutrition?

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60. (A) They possess heat tolerance, disease resistance, and ability to thrive on poor roughages.
Conserving indigenous livestock breeds is crucial for genetic diversity and sustainable agriculture. Native breeds possess exceptional heat tolerance, strong resistance to tropical diseases and endemic parasites, and the physiological capability to maintain body weight and produce milk while feeding on low quality fibrous roughages under harsh environmental and drought conditions.

61. (B) 2000 - 2500 kg
Under standard management and scientific feeding, a well-managed indigenous Sahiwal cow achieves an average lactation yield ranging between two thousand and two thousand five hundred kilograms of milk over a three hundred five day lactation period. Exceptional elite farm cows can exceed three thousand kilograms, establishing Sahiwal as India's premier indigenous milch breed.

62. (C) I and III only
Pedigree records detailing maternal milk history provide essential selection criteria for young dairy heifers before lactation starts. Milk yield depends on both genetic inheritance and optimal management factors like balanced nutrition. A fleshy, pendulous udder lacking prominent milk veins indicates fatty tissue rather than high milk capacity, making statement two incorrect.

63. (A) Crossbred offspring exhibiting superior performance traits over purebred parent averages.
Heterosis, or hybrid vigor, describes the biological phenomenon where crossbred offspring display superior phenotypic performance in economic traits such as growth rate, lactation milk yield, fertility, and disease resistance compared to the average performance of their purebred parents. This principle forms the genetic foundation for commercial crossbreeding programs in livestock.

64. (C) Jamunapari
Jamunapari is the premier indigenous dairy goat breed native to the Chambal ravine area of Etawah district in Uttar Pradesh. Renowned for its large body frame and high milk production capacity, lactating does produce two to three kilograms of milk daily, making it the most suitable regional goat for milk marketing.

65. (D) Accurate detection of estrus (heat) in cows and heifers.
Teaser bulls are surgically vasectomized or penile-deviated male bovines that retain normal sexual desire but cannot fertilize cows. They are maintained on modern dairy farms to actively search for and accurately identify female cows and heifers in estrus, facilitating timely artificial insemination and ensuring high overall conception rates across the herd.

66. (C) III only
Polyurethane ear tags provide tamper-proof, long-lasting physical identification required for digital national livestock health databases and livestock insurance policy enrollment. Tagging is a non-invasive physical marking procedure that attaches an external token to ear cartilage. It alters no biological functions and has absolutely no impact on the animal's underlying cellular or genetic DNA.

67. (B) Amritmahal
Amritmahal is an iconic pure draft cattle breed originating from Karnataka. Historically developed for military transport and heavy agricultural labor, Amritmahal bullocks are celebrated across India for their unmatched speed, endurance, spirit, and power. They feature long tapering horns, a compact muscular body, and incredible agility during heavy field work.

68. (A) P-3, Q-1, R-4, S-2
In standard animal breeding terminology, sire refers specifically to the male parent of an animal, while dam denotes the female parent. Pedigree represents the documented genealogical record or ancestral lineage of an individual animal over successive generations. Progeny refers to the offspring produced by a specific sire or dam combination.

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69. (A) Osteomalacia
Osteomalacia is a chronic metabolic bone disease in adult lactating cows caused by prolonged dietary deficiencies of calcium, phosphorus, or vitamin D. High milk yields rapidly deplete mineral reserves from bones, leading to bone softening, painful gait, lameness, spontaneous fractures, reduced milk production, and systemic weakness requiring immediate dietary mineral supplementation.

gland system, reflecting the functional capacity of the udder to synthesize large quantities of milk during peak lactation.

50. (C) Abomasum
Ruminant animals possess a complex stomach divided into four functional compartments: rumen, reticulum, omasum, and abomasum. The abomasum is recognized as the true glandular stomach because it secretes gastric juices containing hydrochloric acid and digestive enzymes like peψn and rennin, facilitating direct enzymatic breakdown of proteins prior to intestinal absorption.

51. (A) P-3, Q-4, R-1, S-2
Gangatiri cattle are native to Varanasi and Ghazipur along the Ganges river. Bhadawari buffaloes originate from the ravine areas of Agra and Etawah. Ponwar cattle are native to the foothill forests of Pilibhit. Barbari goats are extensively found across the semi-arid urban and ravine belts of Agra, Mathura, and Etawah.

52. (D) Black Bengal
Black Bengal is a highly prolific goat breed native to West Bengal, Bihar, and Jharkhand. Renowned for generating tender meat and high-grade leather skins, females frequently yield twin, triplet, or quadruplet births. Its high fecundity, early sexual maturity, and disease resistance render it exceptionally valuable for resource-poor rural goat rearers.

53. (A) Breed multiplication, fodder seed production, and livestock insurance.
The National Livestock Mission targets structural interventions to boost overall sector productivity. Financial subsidies and government support focus heavily on establishing private breed multiplication farms, increasing high-yielding fodder seed production, and expanding livestock insurance coverage to mitigate economic risks for farmers, ensuring sustainable growth across dairy, small ruminants, and poultry sub-sectors.

54. (C) Animal health card with ID, vaccination, and breeding records.
Distributed under government livestock health schemes, the Nakul Swasthya Patra serves as an official animal health card. Linked directly to the twelve-digit tag code, it maintains systematic records of an animal's identity, preventive vaccination dates, deworming schedules, artificial insemination details, calving history, and medical treatment records for effective herd monitoring.

55. (A) Reddish-fawn coat and smaller body frame than the black-and-white HF.
Jersey cattle are visually distinguished from Holstein Friesians by their smaller overall body frame, refined head, and distinctive reddish-fawn or light brown coat coloration. In contrast, Holstein Friesians represent the largest dairy breed with a characteristic black-and-white patched coat. Jersey cows also produce milk with higher fat and solid-not-fat contents.

56. (A) I, II, and IV
Artificial insemination maximizes bull genetic utility, while heterosis provides crossbred offspring with faster growth rates and increased milk potential. Timely heat detection by farmers is essential for high artificial insemination success. However, artificial insemination is a breeding technique and does not serve as a cure for reproductive tract bacterial infections in cows.

57. (B) Cara-beef
Cara-beef is the official, legal trade term used in international livestock and meat industries to designate meat derived specifically from water buffaloes. Differentiated from beef (derived from cattle), mutton (from sheep), and chevon (from goats), cara-beef is globally traded due to its low fat content, high lean yield, and nutrient density.

58. (C) Jet black body with no white patches and tightly curled, short horns
Purebred Murrah buffaloes are identified by a solid jet-black body without any white patches on the skin, legs, or face. Their defining phenotypic standard includes short, tightly curled, spiral horns situated close to the head. Any prominent white markings indicate crossbreeding or genetic contamination away from true Murrah breed purity.

59. (D) Middle White Yorkshire
Middle White Yorkshire is an exotic pig breed recognizable by its white coat, erect ears, short snouted dished face, and heavy muscular frame. Originating in England, it was developed by crossing Large White Yorkshire with Cumberland pigs. It is utilized in crossbreeding schemes across India to upgrade growth rates and carcase quality.

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80. (C) Subsidies on the insurance premium are strictly reserved only for large corporate dairy farms.

Animal insurance schemes implemented across Uttar Pradesh prioritize small, marginal, and landless livestock farmers, offering substantial premium subsidies ranging from fifty to seventy-five percent to make insurance affordable. Subsidies are explicitly extended to individual smallholders rather than being reserved for corporate dairy entities, while mandatory ear tagging and official veterinary health certificates apply to all insured animals.

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willing farmers and caretakers receive direct financial support, recently enhanced to fifty rupees per animal daily, to feed and maintain destitute bovine stock handed over from government shelters.

30. (B) Farrowing
In veterinary science and livestock terminology, farrowing is the precise biological term for parturition or giving birth in swine. Calving refers specifically to cattle and buffaloes, kidding describes the act of birth in goats, and whelping denotes giving birth in canines. Proper farrowing management minimizes piglet mortality and ensures sow health.

31. (A) IV, II, III, I
Performing artificial insemination via the recto-vaginal technique requires a strict sequential workflow. First, the female animal is safely restrained in a Travis. Next, the frozen semen straw is thawed in warm water at thirty-seven degrees Celsius. The straw is loaded into the gun, which is then passed gently through the cervix.

32. (C) Assess breed quality, build awareness, and foster competition.
Livestock exhibitions and regional animal melas serve as vital educational and promotional platforms for rural development. They enable agricultural agencies to evaluate breed characteristics, showcase superior animals, disseminate modern animal husbandry techniques, create awareness regarding disease control, and encourage healthy competition among livestock farmers through official recognition, awards, and extension demonstrations.

33. (D) White markings on forehead, face, muzzle, legs, and tail switch.
The Nili-Ravi buffalo breed, native to the Sutlej river valley of Punjab, is famously characterized by distinct white markings on five specific body extremities, known locally as Panj Phool. These characteristic white markings occur on the forehead, face, muzzle, legs, and tail switch, making this high-yielding milch breed easily recognizable in dairy herds.

34. (A) P-2, Q-1, R-4, S-3
The premier National Dairy Research Institute is located in Karnal, Haryana. The Central Institute for Research on Goats is situated at Makhdoom in the Mathura district. The Indian Grassland and Fodder Research Institute is headquartered in Jhansi. The Central Avian Research Institute is established at Izatnagar in Bareilly, Uttar Pradesh.

35. (B) Integrated indigenous cattle development centres for conservation and breed improvement.
Gokul Grams are established as integrated indigenous cattle development centres under the Rashtriya Gokul Mission. Located in primary native breeding tracts, these centres serve as specialized scientific hubs for conserving indigenous bovine genetics, propagating elite germplasm, maintaining high-pedigree herds, manufacturing organic bio-inputs, and training smallholder livestock farmers in modern breeding practices.

36. (D) Haryana
The Haryana cattle breed is widely acknowledged as the finest dual-purpose indigenous bovine breed of North India. Originating from the Haryana region, cows yield good lactation outputs while bullocks display exceptional strength, endurance, and speed for heavy agricultural operations and road haulage, making them popular among farmers across rural farming belts.

37. (A) Genetic worth of a sire based on offspring performance.
Progeny testing is a scientific animal breeding methodology used to accurately evaluate the genetic transmitting ability of a male breeding sire. Since milk production is expressed only in female animals, a sire's breeding value is determined by recording and statistically evaluating the milk performance of his daughters relative to contemporary herd mates.

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38. (C) Animal loss due to disease, accidents, or natural calamities.
The Livestock Insurance Scheme operates to safeguard farmers and livestock rearers against capital losses arising from the unexpected death of valuable animals. Covering mortality due to contagious diseases, surgical accidents, lightning, floods, or fire, the financial compensation provided under insured policies helps farmers replace lost stock and stabilize farm income against risk.

39. (A) I, II, and IV
Physical identification involves ear tagging, branding, or tattooing, while DNA profiling

(A) Iron
(B) Copper
(C) Calcium
(D) Zinc

11. Milk fever in high-yielding dairy cows shortly after calving is caused by an acute deficiency of which mineral in the blood?
(A) Phosphorus
(B) Magnesium
(C) Potassium
(D) Calcium

12. Pica, a condition where animals chew on non-food objects like bones, wood, or soil, is a classic symptom of the deficiency of which mineral?
(A) Phosphorus
(B) Cobalt
(C) Iron
(D) Sodium

13. Read the following statements regarding vitamin requirements in ruminants:
I. Adult ruminants do not usually require dietary supplementation of B-complex vitamins.
II. Vitamin C is synthesized in the tissues of cattle and is rarely deficient.
III. Vitamin A is synthesized abundantly by rumen microbes and does not need to be supplied through green fodder.
Which of the above statement(s) is/are correct?
(A) I and II only
(B) II and III only
(C) I and III only
(D) I, II and III

14. Night blindness and xerophthalmia in calves are primary indicators of the deficiency of which vitamin?
(A) Vitamin D
(B) Vitamin A
(C) Vitamin K
(D) Vitamin E

15. Grass tetany is a fatal metabolic disorder in grazing cattle caused by abnormally low levels of which mineral in the blood serum?
(A) Magnesium
(B) Calcium
(C) Manganese
(D) Selenium

16. Match the following mineral deficiency diseases (List I) with their corresponding deficient mineral (List II):
List I: (Disease)
P. Parakeratosis
Q. Goitre
R. White Muscle Disease
S. Enzootic Marasmus
List II: (Deficient Mineral)
1. Iodine
2. Cobalt
3. Zinc
4. Selenium
(A) P-3, Q-1, R-4, S-2
(B) P-1, Q-2, R-3, S-4
(C) P-4, Q-1, R-2, S-3
(D) P-3, Q-4, R-1, S-2

17. What is the ideal Calcium to Phosphorus (Ca:P) ratio generally recommended in the mineral mixture for lactating dairy animals?
(A) 1:1
(B) 1:2
(C) 2:1
(D) 4:1

18. Approximately how much drinking water is required by a cow to produce one litre of milk, above its daily maintenance need?
(A) 1 to 2 litres
(B) 3 to 4 litres
(C) 8 to 10 litres
(D) 12 to 15 litres

19. Vitamin E works in close synergy with which trace mineral to function as a cellular antioxidant and prevent nutritional muscular dystrophy?
(A) Copper
(B) Selenium
(C) Iron
(D) Molybdenum

20. Consider the following statements regarding the role of minerals in animal feed:
I. Iron is an essential component of hemoglobin.
II. Iodine is required for the synthesis of thyroxine hormone.
III. Excess molybdenum can induce copper deficiency in cattle.
IV. Zinc deficiency leads to poor feathering in poultry and skin lesions in cattle.
Which of the above statement(s) is/are correct?
(A) I, II and III only
(B) II, III and IV only

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(C) I, II and IV only
(D) I, II, III and IV

21. Which term correctly describes the minimum amount of feed required by an animal merely to sustain its life, maintain body weight, and keep body temperature constant without any productive output?
(A) Maintenance ration
(B) Production ration
(C) Balanced ration
(D) Challenge ration

22. For optimal rumen function in dairy cows, what is the generally recommended ratio of dry matter contribution from roughages versus concentrates?
(A) 20% roughage : 80% concentrate
(B) 40% roughage : 60% concentrate
(C) 60% roughage : 40% concentrate
(D) 90% roughage : 10% concentrate

23. The Pearson Square method is a simple mathematical tool used in animal nutrition specifically for which of the following purposes?
(A) Balancing two feeds to achieve a targeted protein level
(B) Calculating the dry matter percentage of fresh fodder crops
(C) Determining the total gross energy value of a raw feedstuff
(D) Measuring the total digestible nutrients in a complex ration

24. Which of the following represents the correct order of physiological priorities for nutrient utilization in a lactating dairy cow facing a nutritional deficit?
(A) Maintenance, followed by Reproduction, followed by Lactation
(B) Maintenance, followed by Lactation, followed by Body Weight Gain
(C) Lactation, followed by Maintenance, followed by Reproduction
(D) Body Weight Gain, followed by Maintenance, followed by Lactation

25. Which among the following feedstuffs is considered the richest source of Digestible Crude Protein (DCP) for dairy animals?
(A) Wheat straw
(B) Groundnut cake
(C) Maize grain
(D) Sorghum fodder

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26. Why are leguminous fodders like Berseem and Lucerne highly recommended in the daily ration of dairy animals compared to non-leguminous fodders?
(A) They have extremely high fat content.
(B) They have lower moisture content than non-legumes.
(C) They are rich sources of calcium and crude protein.
(D) They prevent the formation of methane in the rumen entirely.

27. Which of the following is NOT a characteristic of a perfectly balanced ration?
(A) It contains all essential nutrients in the exact proportion required by the animal.
(B) It is highly palatable and free from toxins.
(C) It meets the dry matter capacity of the animal's digestive tract.
(D) It relies exclusively on dry fodder to maximize dry matter intake.

28. Consider the following assertion and reason statements:
Assertion (A): When dairy cows are fed predominantly on good quality leguminous fodder like Berseem, the need for heavy calcium supplementation is reduced.
Reason (R): Leguminous fodders are naturally very rich in calcium compared to cereal fodders.
(A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
(B) Both Assertion (A) and Reason (R) are true but R is not the correct explanation of A.
(C) Assertion (A) is true but Reason (R) is false.
(D) Assertion (A) is false but Reason (R) is true.

29. In the Weende system of proximate analysis, which fraction estimates the crude fat content of the animal feed?
(A) Crude Fiber
(B) Ether Extract
(C) Nitrogen Free Extract
(D) Total Ash

30. What is the standard concentration of urea solution recommended for the urea treatment of poor-quality roughages like wheat straw to improve their nutritional value?
(A) 1 percent
(B) 4 percent
(C) 10 percent
(D) 15 percent

31. What does the feeding practice known as 'Steaming up' refer to?
(A) Supplementing concentrates to pregnant cows during late gestation
(B) Feeding hot cooked grains to young calves for improving nutrient digestion
(C) Feeding high-quality green fodder to breeding bulls prior to mating season
(D) Subjecting dry coarse roughages to high-pressure steam before feeding

32. What is the recommended quantity and timing for feeding colostrum to a newly born calf?
(A) 5% of body weight after 12 hours of birth
(B) 10% of body weight within 1 to 2 hours of birth
(C) 15% of body weight on the third day of birth
(D) 20% of body weight continuously over the first week

33. As a general thumb rule for production ration, how much concentrate feed should be given to a buffalo for every 2.5 litres of milk produced, over and above its maintenance ration?
(A) 0.5 kg
(B) 1.0 kg
(C) 2.0 kg
(D) 2.5 kg

34. Consider the following statements regarding colostrum:
I. It is rich in immunoglobulins that provide passive immunity to the calf.
II. It acts as a natural laxative to help expel meconium.
III. It contains significantly lower levels of Vitamin A compared to normal milk.
Which of the above statement(s) is/are correct?
(A) I and II only
(B) II and III only
(C) I and III only
(D) I, II and III

35. To ensure proper growth and early rumen development, a good quality calf starter mixture should contain approximately what percentage of Crude Protein (CP)?
(A) 10-12%
(B) 14-16%
(C) 20-23%
(D) 30-35%

36. Why is an additional pregnancy allowance of concentrate required during the last trimester of gestation in cattle?
(A) To stop active milk synthesis in the udder immediately prior to dry period
(B) To gradually reduce the body weight of the heavy cow for easier calving
(C) To significantly increase the fiber digestion capacity of the adult rumen
(D) Rapid foetal growth occurs during this final stage

37. The practice of feeding high levels of concentrate to a dairy cow starting two weeks before calving and continuing after calving to maximize peak milk yield is termed as:
(A) Challenge feeding
(B) Creep feeding
(C) Flushing
(D) Ad libitum feeding

38. Match the following specialized feeding practices (List I) with their target animal group (List II):
List I: (Feeding Practice)
P. Creep feeding
Q. Flushing
R. Steaming up
S. Milk replacer feeding
List II: (Target Animal Group)
1. Breeding ewes before mating
2. Advanced pregnant cows
3. Unweaned young calves
4. Orphaned or early weaned calves
(A) P-3, Q-1, R-2, S-4
(B) P-1, Q-2, R-3, S-4
(C) P-4, Q-3, R-2, S-1
(D) P-3, Q-4, R-1, S-2

39. What is the primary purpose of using a 'milk replacer' in calf rearing?
(A) To reduce rearing costs by saving whole milk for human sale
(B) To completely cure and eliminate nutritional scours in young calves
(C) To fully replace drinking water requirements during cold winter months
(D) To substantially increase the fat percentage of future milk yields

40. Which compartment of the ruminant stomach is fully functional in a newborn calf, allowing milk to bypass the undeveloped rumen?
(A) Rumen
(B) Reticulum

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round fodder availability is technically termed as:
(A) Hortipasture system
(B) Silvipasture system
(C) Agrosilviculture
(D) Alley cropping

63. In the modern Van Soest method of feed analysis, cell wall constituents like cellulose, hemicellulose, and lignin are collectively estimated as:
(A) Neutral Detergent Fiber (NDF)
(B) Crude Fiber (CF)
(C) Acid Detergent Fiber (ADF)
(D) Nitrogen Free Extract (NFE)

64. Consider the following statements regarding fiber fractions in animal feed:
I. The Neutral Detergent Fiber (NDF) content of a forage is inversely related to the animal's voluntary feed intake.
II. The Acid Detergent Fiber (ADF) content is inversely related to the digestibility of the forage.
III. Lignin is highly digestible by rumen microbes and provides significant energy.
Which of the above statement(s) is/are correct?
(A) I and II only
(B) II and III only
(C) I and III only
(D) I, II and III

65. To ensure a continuous supply of green fodder throughout the year in a dairy farm, which crop rotation system is most effective?
(A) Continuous monocropping of Maize on the same land year after year without rotation
(B) Cultivating exclusively perennial tree fodders without integrating any pasture grasses
(C) Leaving the agricultural land fallow for six months to regenerate natural wild grasses
(D) Overlapping cropping system using seasonal legume-cereal fodder rotations

66. In pasture management, the term "Carrying Capacity" refers to:
(A) The maximum weight of green fodder harvested by mechanical equipment in a single day
(B) The total volume of irrigation water required to sustain one hectare of forage pasture
(C) The number of animal units a pasture supports without resource degradation
(D) The cumulative annual dry matter production yield per unit area of pasture land

67. In feed quality testing, the Kjeldahl method determines the total nitrogen content. By what standard factor is this nitrogen value multiplied to estimate the Crude Protein percentage?
(A) 4.25
(B) 5.50
(C) 6.25
(D) 7.50

68. Match the following feed analysis methods (List I) with the nutritional component they estimate (List II):
List I: (Feed Analysis Method)
P. Kjeldahl method
Q. Soxhlet extraction
R. Muffle furnace ashing
S. Bomb calorimetry
List II: (Nutritional Component)
1. Gross Energy
2. Total Ash (Minerals)
3. Crude Protein
4. Ether Extract (Crude Fat)
(A) P-3, Q-4, R-2, S-1
(B) P-4, Q-3, R-1, S-2
(C) P-3, Q-2, R-4, S-1
(D) P-1, Q-4, R-2, S-3

69. Chaffing (cutting into small pieces) of long dry roughages like sorghum stover before feeding is highly recommended primarily because it:
(A) Reduces sorting and minimizes feed wastage
(B) Significantly increases the crude protein content of the dry stover
(C) Completely prevents the formation of ruminal volatile fatty acids
(D) Destroys all harmful anti-nutritional factors present in the plant stem

70. The practice of completely confining livestock to sheds and bringing freshly harvested green fodder to them instead of allowing them to graze is termed:
(A) Rotational grazing
(B) Strip grazing
(C) Zero grazing
(D) Mixed grazing

71. The establishment of 'Fodder Banks' is primarily aimed at:
(A) Preserving fodder blocks or bales for lean periods and natural disasters
(B) Providing low-interest subsidized loans to

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which of the following minerals, necessitating careful calcium balancing in the ration?
(A) Copper
(B) Zinc
(C) Calcium
(D) Phosphorus

53. Compared to expeller-pressed oil cakes, solvent-extracted oil meals are characterized by which of the following?
(A) Almost negligible oil (fat) content
(B) Significantly higher oil (fat) content
(C) Higher moisture content
(D) Much lower crude protein content

54. Consider the following statements regarding common oil cakes fed to livestock:
I. Groundnut cake is a highly palatable and excellent source of crude protein.
II. Cottonseed cake contains gossypol, which is highly toxic to mature ruminants but harmless to poultry.
III. Linseed cake has a laxative effect and imparts a glossy coat to animals.
IV. Soybean meal requires heat treatment before feeding to destroy tryψn inhibitors.
Which of the above statement(s) is/are correct?
(A) I, II and III only
(B) I, III and IV only
(C) II, III and IV only
(D) I, II, III and IV

55. What is the core principle behind formulating an 'Area Specific Mineral Mixture' (ASMM)?
(A) Supplementing minerals based on regional soil and fodder deficiency patterns
(B) Supplying low-cost mineral alternatives to minimize overall milk production costs for dairy farmers
(C) Incorporating broad-spectrum antibiotics and growth hormones targeted against endemic local diseases
(D) Blending naturally collected local soils directly into routine feed to supply trace minerals naturally

56. Water is the most critical nutrient. Approximately what percentage of the body weight of an adult healthy cow consists of water?
(A) 20 - 30%
(B) 40 - 50%
(C) 60 - 70%
(D) 85 - 95%

57. The inclusion of sugarcane molasses in concentrated animal feed mixtures primarily serves which two purposes?
(A) Rich source of bypass protein and insoluble structural fiber
(B) Source of quick energy and feed binder
(C) Primary source of essential fatty acids and fat-soluble vitamins
(D) Major source of non-protein nitrogen compounds and dietary calcium

58. Which of the following represents the correct sequential order of the four compartments of a ruminant stomach through which ingested food passes?
(A) Rumen, Omasum, Reticulum, Abomasum
(B) Rumen, Reticulum, Omasum, Abomasum
(C) Reticulum, Rumen, Abomasum, Omasum
(D) Abomasum, Omasum, Reticulum, Rumen

59. What is the primary nutritional benefit of pelleting finely ground concentrate feed for dairy animals?
(A) It significantly reduces the ruminal digestibility of dietary starch
(B) It completely eliminates the requirement for feeding green fodder to cattle
(C) It substantially increases the overall crude fiber content of feed ingredients
(D) It prevents sorting, reduces dust, and improves intake

60. Which of the following is the most immediate and pronounced physiological response of a lactating cow to severe water deprivation?
(A) Reduced feed intake and a severe drop in milk yield
(B) A rapid and marked rise in core body temperature of the cow
(C) Complete loss of hair coat and skin elasticity
(D) Acute bloat and severe gas retention in the rumen

61. The grazing system where a large pasture is divided into smaller enclosed areas, and animals are moved systematically from one area to another to allow grass regrowth, is known as:
(A) Zero grazing
(B) Rotational grazing
(C) Continuous grazing
(D) Strip grazing

62. The integration of planting multipurpose fodder trees along with pasture grasses to ensure year-

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(C) Omasum
(D) Abomasum

41. Among the following fodder crops, which is considered the most ideal for making high-quality silage due to its thick stem and high soluble carbohydrate content?
(A) Lucerne
(B) Maize
(C) Berseem
(D) Cowpea

42. Which crop is widely considered the most suitable for making high-quality hay due to its fine stem and high leaf proportion?
(A) Sorghum
(B) Bajra (Pearl Millet)
(C) Berseem
(D) Napier grass

43. Consider the following stages of the silage fermentation process:
I. Lactic acid production phase
II. Initial aerobic phase
III. Stable phase
IV. Acetic acid production phase
Which of the following represents the correct chronological sequence from filling the silo to the final preserved state?
(A) II, IV, I, III
(B) I, II, III, IV
(C) II, I, IV, III
(D) IV, II, I, III

44. What is the ideal dry matter (DM) percentage required in the green fodder crop at the time of harvesting for successful silage making?
(A) 10-15%
(B) 30-35%
(C) 55-60%
(D) 80-85%

45. To prevent fungal growth and spoilage during storage, the moisture content of properly cured hay should be reduced to approximately what level?
(A) 35-40%
(B) 25-30%
(C) 12-15%
(D) 2-5%

46. What is the typical pH range of an excellently preserved lactic acid silage?
(A) 2.0 - 3.0
(B) 3.5 - 4.2
(C) 5.5 - 6.5
(D) 7.0 - 7.5

47. Consider the following assertion and reason statements:
Assertion (A): Silos must be heavily compacted and sealed airtight immediately after filling with chaffed fodder.
Reason (R): The lactic acid-producing bacteria responsible for good silage fermentation require strictly anaerobic conditions to multiply.
(A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
(B) Both Assertion (A) and Reason (R) are true but R is not the correct explanation of A.
(C) Assertion (A) is true but Reason (R) is false.
(D) Assertion (A) is false but Reason (R) is true.

48. Hybrid Napier, a highly productive perennial green fodder, is propagated commercially by which method?
(A) Direct sowing of true seeds
(B) Tissue culture only
(C) Root slips or stem cuttings
(D) Grafting on local grass rootstock

49. Feeding young or drought-stressed Sorghum (Jowar) fodder to cattle can cause sudden death due to the presence of which anti-nutritional factor?
(A) High levels of soluble oxalates
(B) Condensed and hydrolysable tannins
(C) Toxic amino acid mimosine
(D) Hydrocyanic acid (HCN)

50. Continuous feeding of high quantities of Pearl Millet (Bajra) or Napier grass may interfere with calcium absorption in cattle due to the high concentration of which compound?
(A) Gossypol
(B) Glucosinolates
(C) Oxalates
(D) Aflatoxin

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51. Mustard cake is a common protein supplement, but its use is limited in high amounts due to its pungent taste and the presence of which toxic factor?
(A) Gossypol
(B) Glucosinolates
(C) Tryψn inhibitors
(D) Saponins

52. Rice bran and wheat bran are excellent feed ingredients, but they are particularly rich in

farmers for purchasing dairy cattle
(C) Exporting certified hybrid fodder seeds to commercial buyers in neighboring countries
(D) Collecting municipal taxes and tariffs on fodder transported across district borders

72. Which volatile fatty acid produced during rumen fermentation is the primary precursor for the synthesis of milk fat in dairy cows?
(A) Propionic acid
(B) Butyric acid
(C) Lactic acid
(D) Acetic acid

73. Which volatile fatty acid is critical for the synthesis of glucose in the liver, which in turn drives lactose production and overall milk volume?
(A) Acetic acid
(B) Propionic acid
(C) Butyric acid
(D) Valeric acid

74. Consider the following assertion and reason statements:
Assertion (A): Feeding a dairy cow a diet that is extremely high in concentrate grains and very low in roughage often leads to a drop in the fat percentage of her milk.
Reason (R): High grain diets alter rumen fermentation by increasing propionate production and decreasing acetate production, which is required for milk fat synthesis.
(A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
(B) Both Assertion (A) and Reason (R) are true but R is not the correct explanation of A.
(C) Assertion (A) is true but Reason (R) is false.
(D) Assertion (A) is false but Reason (R) is true.

75. Azolla, which is promoted as an economical alternative feed for livestock, is botanically a type of:
(A) Leguminous shrub
(B) Deep-rooted perennial grass
(C) Blue-green algae
(D) Floating aquatic fern

76. What is the approximate crude protein content of Azolla on a dry matter basis, making it an excellent supplementary feed?
(A) 5 - 10%
(B) 12 - 15%
(C) 25 - 30%
(D) 45 - 50%

77. Consider the following statements regarding the cultivation and feeding of Azolla:
I. It can be easily grown in shallow artificial pits lined with silpaulin sheets.
II. It requires partial shade for optimal growth and multiplication.
III. It can completely replace the dry roughage requirement of an adult cow.
IV. It is rich in essential amino acids, vitamins, and minerals.
Which of the above statement(s) is/are correct?
(A) I, II and III only
(B) I, II and IV only
(C) II, III and IV only
(D) I, III and IV only

78. In programs for feed and fodder development, financial assistance is primarily provided for which of the following activities?
(A) Subsidizing the commercial import of synthetic milk replacers for livestock
(B) Establishing fodder block units and utilizing crop residues
(C) Providing direct state subsidies for the slaughter of unproductive animals
(D) Distributing free crossbred dairy cows to smallholder rural farmers

79. Consider the following statements regarding the practical feeding of fresh Azolla to dairy animals:
I. Fresh Azolla should be washed thoroughly with clean water to remove the smell of cow dung before feeding.
II. It is highly toxic if fed in the green state and must always be dried into hay first.
III. The recommended daily feeding rate of fresh Azolla for an adult cow is usually 1.5 to 2.0 kg.
Which of the above statement(s) is/are correct?
(A) I only
(B) I and III only
(C) II and III only
(D) I, II and III

80. To provide essential nutrients to livestock during scarcity and to utilize poor-quality roughages efficiently, dairy cooperatives widely distribute 'UMMB'. What does UMMB stand for?
(A) Unprocessed Maize and Millet Bran
(B) Urea Mixed Methane Blocker
(C) Urea Molasses Mineral Block
(D) Universal Mineral Mixture Base

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ANSWERS

1. (D) Total Digestible Nutrients
Total Digestible Nutrients serves as a traditional standard measure used in animal nutrition to express the energy value of feedstuffs. It accounts for digestible crude protein, digestible crude fiber, digestible nitrogen-free extract, and digestible ether extract multiplied by a factor of two point two five to reflect the higher energy density of fat content.

2. (C) Urea
Urea is an organic compound that contains forty-six percent nitrogen, making it a highly concentrated source of non-protein nitrogen for ruminant animals. Microorganisms within the rumen utilize urease enzymes to convert urea into ammonia, which is subsequently combined with carbohydrate keto-acids to synthesize high-quality microbial protein essential for growth and production.

3. (C) 2.25 times
Lipids and crude fats contain a significantly higher proportion of carbon and hydrogen atoms relative to oxygen compared with carbohydrates. Consequently, complete oxidation of one gram of fat yields approximately nine point four five kilocalories of gross energy, whereas carbohydrates yield four point two kilocalories per gram, establishing that fat yields two point two five times more energy.

4. (A) P-3, Q-1, R-4, S-2
Carbohydrates serve as the primary source of readily available energy for physiological functions. Proteins supply essential amino acids required for tissue development, cellular repair, and enzyme synthesis. Calcium acts as a vital structural mineral necessary for skeletal bone and teeth formation, while Vitamin A plays a fundamental role in maintaining ocular vision and epithelial health.

5. (B) 18 percent
In animal feed classification systems, feedstuffs are broadly categorized as roughages or concentrates based on their fiber content. A roughage is defined as any feed material that contains more than eighteen percent crude fiber and less than sixty percent total digestible nutrients on a dry matter basis, providing essential bulk for healthy gastrointestinal functioning.

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6. (C) Soluble carbohydrates
Nitrogen Free Extract is calculated by subtracting the percentages of moisture, crude protein, crude fat, crude fiber, and total ash from one hundred in the proximate analysis system. It represents the readily digestible, non-structural soluble carbohydrate fraction, including simple sugars, starches, and organic acids, which provide easily accessible metabolic energy to the consuming animal.

7. (A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
Ruminants possess a specialized fermentation stomach populated by dense colonies of symbiotic bacteria, protozoa, and fungi. These microbes break down non-protein nitrogen sources like urea into ammonia and utilize this inorganic nitrogen to construct cellular proteins. As microbial cells pass into the lower digestive tract, they are digested, absorbing high-quality amino acids for the host animal.

8. (D) It escapes microbial degradation in the rumen to be digested in the abomasum.
Bypass protein, or rumen undegradable protein, resists enzymatic degradation by microorganisms within the rumen. It moves directly into the true stomach, known as the abomasum, and the small intestine, where it is broken down by host digestive enzymes into essential amino acids that are directly absorbed to meet high milk production demands.

9. (B) 8 to 10 kg
The standard daily dry matter requirement for non-lactating or baseline adult cattle is generally estimated at two to two point five percent of their total body weight. For an adult cow weighing four hundred kilograms, calculating two to two point five percent yields a daily intake requirement ranging precisely between eight and ten kilograms of dry matter.

10. (C) Calcium
Macro-minerals are required by animals in relatively large amounts, typically expressed as grams per day or percentages of the dietary dry matter. Calcium is a vital macro-mineral involved in bone development, blood clotting, muscle contraction, and nerve transmission, unlike micro-minerals like iron, copper, and zinc which are needed only in trace milligram quantities.

11. (D) Calcium
Milk fever, or parturient paresis, is a metabolic disease occurring around calving due to a rapid draw of blood calcium into colostrum synthesis. When homeostatic mechanisms fail to mobilize bone calcium quickly enough, acute hypocalcemia results, leading to muscular weakness, progressive loss of consciousness, sternal recumbency, and potential mortality if left untreated.

12. (A) Phosphorus
Pica is an abnormal depraved appetite characterized by animals chewing or eating non-nutritive materials such as bones, wood, soil, and stones. This behavioral anomaly is a classical clinical symptom of chronic phosphorus deficiency, which severely disrupts energy metabolism, reduces voluntary feed intake, impairs skeletal growth, and decreases overall animal reproductive efficiency.

13. (A) I and II only
Functional rumen microbes synthesize all B-complex vitamins in adequate quantities to meet host requirements. Tissues in cattle naturally synthesize Vitamin C from glucose pathways, making dietary supplementation unnecessary. However, rumen microbes do not synthesize Vitamin A; it must be obtained through dietary precursors like beta-carotene present in green forage crops.

14. (B) Vitamin A
Vitamin A is essential for forming rhodoψn in retinal rods, enabling normal vision in low-light conditions. It also maintains specialized epithelial structures throughout the body. Deficiency of this fat-soluble vitamin causes nyctalopia, or night blindness, followed by xerophthalmia, excessive lacrimation, keratinization of mucus membranes, increased disease susceptibility, and poor growth.

15. (A) Magnesium
Grass tetany, also known as lactation tetany or grass staggers, is a metabolic disorder resulting from acute hypomagnesemia. It commonly affects ruminants grazing on lush, rapidly growing spring pastures that are low in magnesium and high in potassium and nitrogen, leading to clinical signs like muscular twitching, uncoordinated gait, convulsions, and sudden mortality.

16. (A) P-3, Q-1, R-4, S-2
Parakeratosis is a severe skin condition resulting from zinc deficiency. Goitre involves thyroid gland enlargement caused by insufficient iodine. White muscle disease causes degeneration of cardiac and skeletal muscles due to selenium deficiency. Enzootic marasmus, or bush sickness, stems from cobalt deficiency, which prevents rumen microflora from synthesizing Vitamin B12.

17. (C) 2:1
In animal nutrition, maintaining a balanced dietary Calcium to Phosphorus ratio is critical for optimal bone mineralization and enzymatic activity. For lactating dairy cattle, a ratio of two parts Calcium to one part Phosphorus is standard, matching the natural ratio excreted in milk and facilitating balanced intestinal absorption of both macro-minerals.

18. (B) 3 to 4 litres
Water is the single most critical nutrient for milk synthesis, given that milk contains approximately eighty-seven percent water. In addition to meeting basic physiological maintenance needs, lactating dairy cows require an additional three to four litres of clean drinking water for every single litre of milk produced to sustain systemic hydration and milk output.

19. (B) Selenium
Vitamin E and selenium function synergistically to protect host body tissues against cellular lipid peroxidation and oxidative damage. Vitamin E acts as a membrane-bound antioxidant neutralizing free radicals, while selenium is an essential structural component of the enzyme glutathione peroxidase. Together, they effectively prevent nutritional muscular dystrophy, or white muscle disease, in young livestock.

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20. (D) I, II, III and IV
Iron forms the central heme group in hemoglobin for systemic oxygen transport. Iodine synthesizes thyroid hormones like thyroxine regulating metabolic rate. High dietary molybdenum induces secondary copper deficiency by forming insoluble thiomolybdates. Zinc activates essential enzymes, so its deficiency causes parakeratotic skin lesions in cattle and improper feather development in poultry species.

21. (A) Maintenance ration
A maintenance ration represents the essential daily dietary nutrient intake required to preserve basic physiological metabolic processes, maintain constant body temperature, support vital organ activities, and prevent loss of body weight in an animal. This baseline nutritional intake supports basic life functions without providing additional energy or nutrients for growth, reproduction, or milk yield.

22. (C) 60% roughage : 40% concentrate
Maintaining an optimal dietary balance of sixty percent dry matter from roughages and forty percent from concentrates ensures healthy microbial digestion in dairy cows. Adequate structural roughage stimulates cud-chewing and saliva secretion containing natural bicarbonate buffers. This keeps the ruminal pH stable, prevents digestive disorders like acidosis, and maintains optimal acetate production for butterfat synthesis.

23. (A) Balancing two feeds to achieve a targeted protein level
The Pearson Square method is a straightforward mathematical technique utilized in animal nutrition formulation. It allows formulators to mix two available feed ingredients with differing concentrations of a specific nutrient, most commonly crude protein, to construct a final diet blend that satisfies a target concentration required by the livestock animal.

24. (B) Maintenance, followed by Lactation, followed by Body Weight Gain
Ruminant physiological systems prioritize essential nutrient partition according to life-sustaining drives. Maintenance functions, including metabolic regulation and organ survival, receive highest priority. Lactation occupies secondary priority, causing high-yielding cows to mobilize adipose tissue during early lactation deficits. Body weight gain and lipid replenishment receive lowest priority, occurring only when dietary nutrients exceed maintenance and milk yield demands.

25. (B) Groundnut cake
Groundnut cake, an oilseed byproduct extracted from peanuts, is a highly palatable protein concentrate containing forty to forty-five percent total crude protein. Due to its high protein content and superior intestinal digestibility coefficient, it provides approximately thirty-five to thirty-eight percent digestible crude protein, making it significantly richer than cereal grains or roughage sources.

26. (C) They are rich sources of calcium and crude protein.
Leguminous green fodders such as Berseem and Lucerne establish symbiotic root associations with Rhizobium bacteria to fix atmospheric nitrogen. Consequently, leguminous forages accumulate high crude protein levels between sixteen and twenty-two percent on a dry matter basis along with substantial calcium concentrations, significantly outperforming non-leguminous cereal forages in overall nutritive value.

27. (D) It relies exclusively on dry fodder to maximize dry matter intake.
A balanced ration must supply all essential nutrients, including proteins, carbohydrates, fats, minerals, and vitamins, in correct amounts and proportions. Relying exclusively on dry fodder creates severe protein, mineral, and energy deficiencies. Optimal livestock rations properly combine dry roughages, succulents or green fodders, and concentrate feeds to ensure health and productivity.

28. (A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
Leguminous forages such as Berseem absorb large amounts of soil calcium during growth, containing up to one point five percent calcium on a dry matter basis. Feeding high quantities of quality leguminous green fodder naturally satisfies a significant portion of the daily calcium requirement in dairy cattle, directly reducing supplementary calcium demands.

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29. (B) Ether Extract
In the Weende system of proximate analysis, feed materials are extracted with diethyl ether or petroleum ether using a Soxhlet apparatus. The resulting fraction, designated as Ether Extract, estimates total crude fat, including true fats, triglycerides, free fatty acids, plant waxes, resins, organic pigments, and fat-soluble vitamins present in feedstuffs.

30. (B) 4 percent
Treating poor-quality crop residues such as wheat straw with a four percent urea solution dissolved in forty litres of water per one hundred kilograms of straw represents the standard recommended protocol. This chemical treatment disrupts lignocellulosic bonds, improves structural digestibility, softens fibrous stalks, and enhances total crude protein equivalent and intake in ruminants.

31. (A) Supplementing concentrates to pregnant cows during late gestation
Steaming up is the nutritional practice of feeding increasing amounts of concentrate mixture to pregnant dairy animals during the last two to three weeks prior to calving. This builds body reserves, adapts ruminal microflora to high-energy feeds, prevents metabolic disorders like ketosis, and ensures optimal peak milk production following parturition.

32. (B) 10% of body weight within 1 to 2 hours of birth
Newborn calves are born without circulating antibodies due to syndesmochorial placentation. Feeding fresh colostrum at ten percent of the calf's total body weight within one to two hours after birth is vital because gut intestinal permeability for intact immunoglobulin macromolecule absorption declines rapidly after birth and closes completely within twenty-four total hours.

33. (B) 1.0 kg
Buffalo milk contains higher butterfat and total solids percentage compared to cattle milk, requiring greater energy and protein density per litre synthesized. As a standard management thumb rule, buffaloes receive one kilogram of concentrate mixture for every two point five litres of milk produced, supplementing their daily maintenance ration allowance.

34. (A) I and II only
Colostrum is rich in immunoglobulins, specifically IgG, which provide essential passive immunity to newborn calves. It contains magnesium salts that exert a mild laxative effect to help clear meconium from the digestive tract. Furthermore, colostrum contains up to ten times higher concentration of Vitamin A compared with standard normal bovine milk.

35. (C) 20-23%
A calf starter is a highly palatable, nutrient-dense dry concentrate mixture introduced to young calves from two weeks of age. It should contain twenty to twenty-three percent crude protein and high digestible energy to support rapid muscular tissue growth and stimulate early ruminal papillae development during the pre-weaning transition phase.

36. (D) Rapid foetal growth occurs during this final stage
During the final trimester of gestation in cattle, approximately seventy to eighty percent of total fetal weight gain occurs. To meet the elevated metabolic demands of the rapidly growing fetus, placenta, and uterus, pregnant cows require an additional concentrate allowance over maintenance to prevent excessive maternal weight loss and ensure strong calf birth weight.

37. (A) Challenge feeding
Challenge feeding, or lead feeding, involves offering increasing quantities of concentrate mix starting approximately two weeks before expected calving and continuing post-calving until peak milk production is reached. This challenges the cow to achieve her full genetic potential for milk production while conditioning the ruminal papillae to high-concentrate feeds and preventing severe metabolic imbalance.

38. (A) P-3, Q-1, R-2, S-4
Creep feeding supplies supplemental grain mixtures exclusively to unweaned young suckling animals. Flushing provides extra nutrition to breeding ewes prior to mating to increase ovulation rates. Steaming up provides high-energy supplementation to advanced pregnant cows during late gestation. Milk replacer offers an economical dietary liquid alternative for early-weaned or orphaned young calves.

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39. (A) To reduce rearing costs by saving whole milk for human sale
Milk replacers are specially formulated liquid diets composed of milk byproducts, vegetable fats, vitamins, and minerals designed to nourish young calves. Using milk replacers substantially lowers rearing costs because whole bovine milk can be saved and sold to liquid milk markets, providing economic advantage while supporting optimal calf growth and development rates.

40. (D) Abomasum
At birth, a calf functions non-ruminantly because the rumen, reticulum, and omasum are underdeveloped. The abomasum is the only fully developed and functional gastric compartment. Suckling behavior triggers reflex closure of the reticular groove, directing ingested milk straight into the abomasum for acid and enzymatic digestion without undergoing prior ruminal microbial fermentation.

41. (B) Maize
Maize is considered the most ideal forage crop for silage production because it naturally possesses high soluble sugar concentrations and optimal dry matter content at harvest. These soluble carbohydrates provide abundant substrates for anaerobic lactic acid bacteria, facilitating rapid pH drop and excellent preservation of the ensiled green forage without excessive nutrient loss.

42. (C) Berseem
Berseem, or Egyptian clover, is widely recognized as an exceptional forage crop for high-quality hay making due to its soft, thin stems and dense leafy foliage. Fine stems facilitate rapid, uniform field drying during wilting, preventing leaf shatter and preserving substantial levels of crude protein, carotene, and calcium in the preserved dry forage.

43. (A) II, IV, I, III
Silage fermentation begins with an initial aerobic phase where entrapped oxygen is rapidly consumed by cellular respiration. As anaerobic conditions establish, heterofermentative microflora initially produce acetic acid, lowering pH. Subsequently, homofermentative lactic acid bacteria dominate, producing high concentrations of lactic acid. Finally, the material reaches a stable, preserved equilibrium phase.

44. (B) 30-35%
Successful silage production requires harvesting or wilting forage crops to achieve thirty to thirty-five percent dry matter. Moisture levels above seventy percent lead to unwanted clostridial fermentation and nutrient leaching as effluent, whereas excessively dry material above forty percent dry matter prevents thorough compaction, causing air entrapment and fungal spoilage.

45. (C) 12-15%
Proper hay curing requires reducing the moisture content of green forage down to twelve to fifteen percent prior to baling or storage. Excess moisture above twenty percent promotes microbial respiration, heating, nutrient destruction, and growth of toxic molds, whereas reducing moisture below twelve percent prevents mold development while maintaining physical structural integrity.

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46. (B) 3.5 - 4.2
Excellent silage preservation relies on rapid anaerobic accumulation of lactic acid, which drops the pH to a stable range between three point five and four point two. This acidic environment inhibits harmful spoilage bacteria, including proteolytic Clostridia and enterobacteria, effectively stabilizing organic nutrients and preventing protein degradation in stored fodder.

47. (A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
Air exclusion during silo filling is essential because desirable lactic acid bacteria are anaerobic organisms. Thorough compaction of chaffed fodder eliminates internal air pockets, halting plant cell respiration. This establishes strictly anaerobic conditions required for lactic acid bacteria to multiply rapidly, convert plant sugars into lactic acid, and preserve the silage.

48. (C) Root slips or stem cuttings
Hybrid Napier, or Pennisetum purpureum cross, is an interspecific sterile hybrid that produces non-viable seeds. Consequently, commercial field propagation depends exclusively on vegetative methods utilizing healthy rooted slips or stem cuttings possessing two to three nodes, ensuring genetic uniformity, rapid vegetative establishment, and continuous high-yielding multi-cut green fodder harvesting potential.

(B) Sahiwal
(C) Hallikar
(D) Khillari

39. Which method is most commonly utilized for castrating scrub bulls to prevent them from indiscriminately breeding with the herd?
(A) Open surgical castration conducted under general anesthesia
(B) Chemical sterilization techniques administered via feed additives
(C) High-precision laser cauterization of the spermatic cord
(D) Burdizzo castrator method involving bloodless castration

40. At what approximate body weight should a crossbred Holstein Friesian heifer be targeted for her first artificial insemination?
(A) 100 to 120 kg
(B) 150 to 180 kg
(C) 250 to 280 kg
(D) 450 to 500 kg

41. Match List I with List II regarding reproductive functions in breeding:
List I: (Hormone)
P. Estrogen
Q. Progesterone
R. Oxytocin
S. Follicle Stimulating Hormone (FSH)
List II: (Primary Reproductive Function)
1. Induces superovulation in donor cows
2. Maintains pregnancy and suppresses estrus
3. Induces behavioral signs of estrus
4. Causes milk let-down and uterine contractions
(A) P-3, Q-2, R-4, S-1
(B) P-1, Q-2, R-3, S-4
(C) P-3, Q-4, R-2, S-1
(D) P-2, Q-3, R-1, S-4

42. In modern breeding management, the 'Ovsynch' protocol is frequently used. What is the primary purpose of this protocol?
(A) To synchronize ovulation for timed insemination without heat detection
(B) To safely induce abortion in cases of accidental or unwanted pregnancies
(C) To significantly increase the overall daily milk yield of lactating cows
(D) To effectively cure clinical mastitis infections in high-yielding cows

43. Which hormone is injected into a cow to cause luteolysis (regression of the corpus luteum) and bring the animal into estrus?
(A) Prolactin
(B) Growth Hormone
(C) Adrenaline
(D) Prostaglandin F2-alpha (PGF2α)

44. What is a 'teaser bull' primarily used for in dairy herd management?
(A) For providing natural service to chronic repeat breeder cows
(B) To detect estrus in females without completing fertile mating
(C) To donate high-quality semen samples for cryopreservation
(D) To protect grazing herds from natural field predators

45. Consider the following statements regarding the use of artificial vaginas (AV) for semen collection from breeding bulls:
I. The internal temperature of the AV should be maintained around 42 °C to 45 °C.
II. Proper pressure must be maintained inside the AV to simulate natural mating conditions.
III. The inner rubber liner must be heavily coated with spermicidal lubricants.
Which of the above statement(s) is/are correct?
(A) I and II only
(B) II and III only
(C) I and III only
(D) I, II, and III

46. During the microscopic evaluation of freshly collected bovine semen, what does 'mass activity' primarily indicate?
(A) The exact percentage of dead and abnormal sperm cells in ejaculate
(B) The presence of harmful bacterial contamination in the sample
(C) The overall fluid volume of the freshly collected ejaculate
(D) The overall vigor and motility of spermatozoa in thick semen

47. What is the act of giving birth in cattle formally called?
(A) Calving
(B) Farrowing
(C) Kidding
(D) Lambing

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59. (D) It prevents sorting, reduces dust, and improves intake
Pelleting compresses ground feed ingredients into uniform dense pellets using moisture, heat, and pressure. This physical processing prevents livestock from selectively sorting individual feed components, significantly reduces feed wastage and atmospheric dustiness, increases bulk density, improves voluntary feed intake, and improves overall starch digestibility through partial heat gelatinization during processing.

60. (A) Reduced feed intake and a severe drop in milk yield
Water restriction rapidly elevates physiological stress in lactating cows, causing immediate reduction in dry matter intake to limit metabolic hemoconcentration. Because milk production requires vast quantities of systemic water for fluid secretion, severe water restriction results in an immediate, dramatic decline in milk yield within hours to conserve body water balance.

61. (B) Rotational grazing
Rotational grazing divides a total pasture area into smaller sub-paddocks using temporary or permanent fencing. Livestock graze one paddock intensely for a short period before being moved sequentially to another. This management practice allows grazed paddocks adequate rest periods to recover, regenerate leaf area, restore root reserves, and maximize pasture yield.

62. (B) Silvipasture system
Silvipasture is an agroforestry practice integrating forestry trees, high-yielding forage grasses, and livestock grazing on the same land unit. Deep-rooted perennial fodder trees provide high-protein top feed foliage during dry seasons when grasses brown off, optimizing overall land-use efficiency, improving soil fertility, providing livestock shade, and ensuring stable year-round fodder supply.

63. (A) Neutral Detergent Fiber (NDF)
In the Van Soest detergent system, boiling feed samples in a neutral detergent solution dissolves soluble cell contents like proteins, starches, and sugars. The insoluble residue remaining represents Neutral Detergent Fiber, which contains structural plant cell wall components including cellulose, hemicellulose, and lignin, providing an accurate indicator of total feed bulk and intake.

64. (A) I and II only
Neutral Detergent Fiber represents plant cell wall bulk, filling ruminal capacity and inversely correlating with voluntary intake. Acid Detergent Fiber contains cellulose and lignin, resisting digestion and inversely correlating with forage digestibility. Lignin is an indigestible complex polymer that coats plant cell walls, resisting microbial degradation and reducing forage digestibility.

65. (D) Overlapping cropping system using seasonal legume-cereal fodder rotations
Sustaining year-round green fodder production requires an overlapping cropping system that strategically sequences seasonal leguminous and cereal crops. Combining summer cereals like Sorghum or Maize with winter legumes like Berseem or Lucerne and perennial grasses ensures balanced high-protein and high-energy forage production across all agricultural seasons without experiencing dry feed scarcity.

66. (C) The number of animal units a pasture supports without resource degradation
Carrying capacity in pasture management represents the maximum density of standardized animal units that a specific forage land area can sustainably feed over a given timeframe without degrading soil health, vegetation coverage, or future forage productivity. Stocking pastures beyond their natural carrying capacity leads to severe overgrazing, soil erosion, and pasture degradation.

67. (C) 6.25
The Kjeldahl analytical technique quantifies total organic nitrogen present within feedstuffs. Because average plant and animal proteins contain approximately sixteen percent nitrogen by mass, dividing one hundred by sixteen yields six point two five. Consequently, multiplying total nitrogen content by six point two five provides the accepted standard crude protein calculation.

68. (A) P-3, Q-4, R-2, S-1
The Kjeldahl digestion method measures total organic nitrogen to calculate crude protein. Soxhlet solvent extraction isolates ether extract representing lipid crude fat. High-temperature muffle furnace combustion leaves total ash representing inorganic mineral matter. Bomb calorimetry measures heat released during

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complete sample combustion to determine total baseline gross energy caloric content.

69. (A) Reduces sorting and minimizes feed wastage
Chaffing mechanically processes long fibrous roughages into uniform short particle sizes. This physical reduction prevents livestock from selectively eating leaves while rejecting tough stem parts, thereby significantly reducing feed wastage. Chaffing also improves dry matter intake and enhances mixing efficiency when blending roughages with green fodders or concentrate feed supplements.

70. (C) Zero grazing
Zero grazing, also known as stall-feeding or cut-and-carry management, involves confining livestock inside animal housing and transporting harvested forage directly to them. This system eliminates pasture trampling, prevents selective grazing, maximizes forage production yield per unit land area, reduces parasitic infestation risks, and allows precise monitoring of individual feed intake.

71. (A) Preserving fodder blocks or bales for lean periods and natural disasters
Fodder Banks are centralized storage facilities established to conserve surplus forage in the form of compressed fodder blocks, hay bales, or silage during peak growth seasons. These reserves are stockpiled to supply nutritious feed to livestock during lean summer months, droughts, floods, and natural calamities, stabilizing livestock production and preventing starvation.

72. (D) Acetic acid
Acetic acid, produced abundantly during ruminal microflora fermentation of structural carbohydrates like cellulose and hemicellulose, enters the systemic circulatory system to serve as the chief precursor for de novo short- and medium-chain fatty acid synthesis within the mammary gland epithelial cells, directly driving milk fat percentage in lactating dairy cattle.

73. (B) Propionic acid
Propionic acid is the principal glucogenic volatile fatty acid absorbed from the rumen into hepatic portal circulation. Within the liver, propionate undergoes gluconeogenesis to produce glucose. Blood glucose supplied to mammary glands acts as the essential substrate for lactose synthesis, drawing water osmotically into milk vesicles and controlling overall milk yield volume.

74. (A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
High concentrate diets rich in soluble starches shift ruminal microbial populations toward amylolytic bacteria, favoring propionate production while reducing acetate production. Because acetate is the principal precursor for mammary de novo fatty acid synthesis, a reduction in acetate availability leads directly to a marked drop in milk fat percentage in dairy cows.

75. (D) Floating aquatic fern
Azolla is a genus of small, free-floating aquatic ferns belonging to the family Salviniaceae. It maintains a symbiotic association with the nitrogen-fixing cyanobacterium Anabaena azollae. This biological symbiosis allows Azolla to fix atmospheric nitrogen rapidly, producing abundant biomass rich in crude protein, minerals, and essential amino acids suitable for livestock feeding.

76. (C) 25 - 30%
On a dry matter basis, Azolla biomass contains twenty-five to thirty percent crude protein, rendering it highly comparable to conventional oilseed meals. In addition to high crude protein content, Azolla provides essential amino acids, beta-carotene, Vitamin A, Vitamin B12, calcium, phosphorus, potassium, iron, and magnesium, functioning as an economical protein supplement.

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77. (B) I, II and IV only
Azolla grows efficiently in shallow artificial water pits lined with silpaulin sheets under partial shade. Its nutrient profile offers essential amino acids, vitamins, and minerals. However, Azolla cannot replace dry roughages due to its extremely low dry matter content of around five to seven percent; it serves as a protein supplement.

78. (B) Establishing fodder block units and utilizing crop residues
Feed and fodder development schemes prioritize sustainable resource utilization by providing financial incentives for establishing fodder block making units, densified straw processing plants, and crop residue enrichment facilities. These developmental interventions improve nutritional value, facilitate transport and storage of

agricultural byproducts, prevent open straw burning, and ensure regional fodder security.

79. (B) I and III only
Freshly harvested Azolla requires thorough washing with clean water to eliminate cow dung odor and residual soil. It is completely non-toxic and can be fed directly in its fresh green state, typically at one point five to two kilograms per cow daily mixed with concentrate, without requiring pre-drying into hay.

80. (C) Urea Molasses Mineral Block
Urea Molasses Mineral Block is a solidified lick supplement composed of urea, molasses, essential macro- and micro-minerals, salt, and binding agents. UMMB provides a slow, continuous supply of non-protein nitrogen and fermentable energy, enhancing microbial digestion of poor-quality roughages, improving cellulolytic bacterial multiplication, and maintaining livestock productivity during seasonal feed scarcity.

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(B) 12 to 14 months
(C) 18 to 20 months
(D) 24 to 26 months

20. Which term refers to a cow that has normal estrus cycles of regular duration but fails to conceive after three or more consecutive artificial inseminations?
(A) Anestrus cow
(B) Nymphomaniac cow
(C) Free-martin
(D) Repeat breeder

21. What is the most common cause of anestrus (failure to exhibit estrus) in Indian dairy cattle and buffaloes?
(A) Excessive and continuous feeding of green fodder crops
(B) Overuse and frequent application of Artificial Insemination
(C) Poor nutrition, energy deficit, and mineral deficiency
(D) High relative environmental humidity and ambient heat

22. Infertility in dairy animals caused by cystic ovarian disease is often characterized by which of the following behavioral symptoms?
(A) Complete cessation of the regular estrus cycle (Anestrus)
(B) Constant, intense, and irregular heat signs (Nymphomania)
(C) Premature calving occurring well before full-term gestation
(D) Retention of fetal membranes or placenta after giving birth

23. Match List I with List II regarding average gestation periods:
List I: (Animal Species)
P. Cow
Q. Buffalo
R. Goat
S. Sow (Pig)
List II: (Average Gestation Period)
1. 114 days
2. 150 days
3. 280 days
4. 310 days
(A) P-3, Q-4, R-2, S-1
(B) P-4, Q-3, R-1, S-2
(C) P-3, Q-4, R-1, S-2
(D) P-2, Q-3, R-4, S-1

24. Which condition is technically defined as the absolute and permanent inability of an animal to reproduce?
(A) Sterility
(B) Sub-fertility
(C) Repeat breeding
(D) Delayed puberty

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25. Which hormone is released by the conceptus (embryo) and is essential for the maternal recognition and maintenance of pregnancy in dairy animals?
(A) Estrogen
(B) Prostaglandin F2-alpha
(C) Progesterone
(D) Oxytocin

26. Which exotic cattle breed is most extensively used in India, including Uttar Pradesh, for crossbreeding programs aiming at maximum milk volume production?
(A) Holstein Friesian
(B) Jersey cattle breed
(C) Brown Swiss cattle
(D) Ayrshire dairy breed

27. Consider the following statements regarding 'Grading up' as a key breeding method:
I. It involves mating non-descript females with purebred sires of a specific breed over successive generations.
II. After 5 to 6 generations, the progeny possesses nearly 98% inheritance of the purebred sire.
III. It is a method used strictly to cross two different recognized pure breeds to produce a hybrid breed.
Which of the above statement(s) is/are INCORRECT?
(A) I only
(B) II only
(C) III only
(D) I and II only

28. In systematic crossbreeding programmes under the National Dairy Breeding Policy, what is the generally recommended maximum safe level of exotic blood inheritance to maintain heat tolerance and disease resistance in the progeny?
(A) Exactly 25 percent
(B) 50 to 62.5 percent
(C) Exactly 75 percent
(D) Exactly 100 percent

produce follicles.
Which of the above statement(s) is/are correct?
(A) I and III only
(B) II and III only
(C) I and II only
(D) I, II, and III

10. The sex-sorted semen technique is increasingly used in dairy farming. What is the primary underlying principle that allows sorting of X and Y bearing sperm?
(A) X-bearing sperm contain slightly more DNA content than Y-bearing sperm
(B) Y-bearing sperm consistently swim significantly faster than X-bearing sperm
(C) X-bearing sperm possess a noticeably shorter tail than Y-bearing sperm
(D) Y-bearing sperm can survive at much lower freezing temperature conditions

11. What is the expected outcome of artificially inseminating a cow using sex-sorted semen targeted for the dairy industry?
(A) Production of 100 percent male calves for draft purposes
(B) Guarantee of twin births in every pregnancy
(C) Elimination of the need for colostrum feeding
(D) Production of 90 percent or more female calves

12. What is the average duration of the estrus cycle in an adult cow?
(A) 11 days
(B) 21 days
(C) 28 days
(D) 35 days

13. Which of the following is a primary physiological and behavioral symptom of a cow in active heat (estrus)?
(A) Complete refusal to drink water or consume forage for 24 hours
(B) A sharp and sudden increase in daily milk production volume
(C) Standing to be mounted and discharging clear stringy mucus
(D) Continuous sleeping, prolonged lethargy, and total inactivity

14. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): The AM-PM rule is widely recommended for the timing of Artificial Insemination in cattle.
Reason (R): Ovulation in cows typically occurs 10 to 14 hours after the end of the estrus phase, so inseminating according to the AM-PM rule ensures sperm are waiting in the oviduct when the egg is released.
(A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A
(B) Both Assertion (A) and Reason (R) are true but R is not the correct explanation of A
(C) Assertion (A) is true but Reason (R) is false
(D) Assertion (A) is false but Reason (R) is true

15. At which stage of the estrus cycle does the corpus luteum reach its maximum functional size and secrete high levels of progesterone?
(A) Proestrus
(B) Estrus
(C) Metestrus
(D) Diestrus

16. What is the average gestation period of a domestic buffalo?
(A) 280 days
(B) 310 days
(C) 340 days
(D) 390 days

17. The earliest reliable method for pregnancy diagnosis (PD) in cattle under field conditions is per-rectal palpation. At what stage post-insemination is this typically performed for accurate confirmation?
(A) 10 to 15 days
(B) 45 to 60 days
(C) 120 to 140 days
(D) 200 to 210 days

18. Consider the following parameters for measuring breeding efficiency in a dairy herd:
I. Calving interval
II. Number of services per conception
III. Days open (Calving to conception interval)
IV. Daily milk fat percentage
Which of the above parameters are directly related to breeding efficiency?
(A) I, II, and III only
(B) I, III, and IV only
(C) II, III, and IV only
(D) I, II, III, and IV

19. What is the ideal targeted calving interval for a profitable crossbred dairy cow?
(A) 9 to 10 months

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CHAPTER 29

Objectives and Methods of Animal Breeding

1. What is the primary objective of animal breeding in the dairy sector?
(A) To expand the total herd size regardless of individual animal milk yield
(B) To improve the genetic potential and economic productivity of animals
(C) To extend the lifespan of animals by eliminating infectious diseases
(D) To reduce and eliminate the need for providing concentrate feeding

2. Which of the following is considered a major limitation of the natural breeding method in cattle?
(A) It limits the maximum number of females a single bull can mate with per year
(B) It completely eliminates the requirement for heat detection by human observers
(C) It consistently guarantees a higher conception rate than artificial methods
(D) It requires specialized laboratory equipment and long-term cryogenic storage

3. What is the standard temperature of liquid nitrogen used for the cryopreservation and storage of frozen bovine semen?
(A) -79 °C
(B) -196 °C
(C) -273 °C
(D) 4 °C

4. Which component is universally added to semen dilutors (extenders) to act as a cryoprotectant and prevent sperm damage during freezing?
(A) Sodium chloride
(B) Penicillin
(C) Fructose
(D) Glycerol

5. Select the correct sequential order of the fundamental steps involved in performing Artificial Insemination (AI) in cattle at the field level.
(A) Loading the AI gun → Thawing of semen → Recto-vaginal insertion → Semen deposition
(B) Thawing of semen → Loading the AI gun → Recto-vaginal insertion → Semen deposition
(C) Recto-vaginal insertion → Thawing of semen → Semen deposition → Loading the AI gun
(D) Loading the AI gun → Recto-vaginal insertion → Thawing of semen → Semen deposition

6. What is the most appropriate temperature and time combination for thawing a frozen semen straw before Artificial Insemination?
(A) 37 °C for 30 to 45 seconds
(B) 4 °C for 5 minutes
(C) 100 °C for 5 seconds
(D) Room temperature for 2 hours

7. What is the standard and most effective site for depositing semen during the Artificial Insemination of a cow?
(A) Deep region of the vaginal canal
(B) Upper portion of uterine horn
(C) Middle section of fallopian tube
(D) Body of the uterus near the cervix

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8. What is the primary benefit of the Multiple Ovulation and Embryo Transfer (MOET) technique in animal breeding?
(A) It increases the offspring yield from a genetically superior female
(B) It allows a genetically superior male bull to sire thousands of calves
(C) It eliminates the need for routine artificial insemination procedures
(D) It completely prevents the occurrence of mastitis in dairy cow herds

9. Consider the following statements regarding 'Silent Heat' in dairy animals:
I. It is characterized by ovulation without distinct outward behavioral signs of estrus.
II. It is more commonly observed in buffaloes than in cows.
III. It indicates complete failure of the ovaries to

29. Which well-known synthetic crossbred cattle strain was developed at the National Dairy Research Institute (NDRI), Karnal, by crossing Tharparkar cows with Holstein Friesian bulls?
(A) Karan Swiss
(B) Sunandini
(C) Karan Fries
(D) Frieswal

30. Which term refers to the mating of individuals that are more closely related than the average of the population, often resulting in a decline in vigor and fertility?
(A) Outcrossing
(B) Crossbreeding
(C) Linebreeding
(D) Inbreeding

31. What is heterosis or hybrid vigor in animal breeding?
(A) Superior performance of crossbred offspring over parent average
(B) The tendency of crossbred offspring to perform worse than parents
(C) The natural development of identical twins from a single embryo
(D) The failure of a fertilized egg to attach to the female uterine wall

32. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): Maintaining accurate pedigree records is essential for a successful selective breeding programme.
Reason (R): Pedigree records allow the breeder to trace the ancestry of animals, estimate genetic potential, and avoid mating closely related individuals.
(A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A
(B) Both Assertion (A) and Reason (R) are true but R is not the correct explanation of A
(C) Assertion (A) is true but Reason (R) is false
(D) Assertion (A) is false but Reason (R) is true

33. A pedigree contains the record of an animal's:
(A) Daily feed consumption and routine dietary intake records
(B) Ancestors (parents, grandparents) and performance records
(C) Progeny and grand-progeny production records evaluated alone
(D) Complete list of veterinary vaccinations and medical treatments

34. Which method of sire evaluation is considered the most accurate for determining the breeding value of a dairy bull for milk production?
(A) Progeny testing
(B) Pedigree selection
(C) Individual phenotypic selection
(D) Tandem selection

35. What is the fundamental requirement for a bull to be selected for semen collection at standard semen stations?
(A) The bull must reach a minimum required age of at least 10 years old
(B) The bull must have successfully mated naturally with at least 100 cows
(C) The bull must be disease-free and possess high proven genetic merit
(D) The bull must be imported directly from a recognized foreign country

36. Consider the following characteristics and criteria for selecting a superior dairy breeding bull:
I. Excellent seminal attributes (volume, concentration, mass motility).
II. High breeding value for economically important traits like milk yield.
III. Freedom from sexually transmitted diseases like Trichomoniasis.
IV. Must always be an exotic purebred, regardless of the target local environment.
Which of the above statements are correct?
(A) I, II, and IV only
(B) I, II, and III only
(C) II, III, and IV only
(D) I, III, and IV only

37. The Rashtriya Gokul Mission, a key component of the national animal breeding policy, primarily focuses on:
(A) Eradicating all indigenous breeds and replacing them with exotic breeds
(B) Promoting beef production and export
(C) Development and conservation of indigenous bovine breeds
(D) Eradication of Foot and Mouth Disease (FMD) exclusively

38. Which of the following is an indigenous dairy cattle breed native to Northern India and well-suited for breeding programmes in Uttar Pradesh?
(A) Kangayam

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49. (D) Hydrocyanic acid (HCN)
Young or drought-stressed Sorghum plants contain high levels of dhurrin, a cyanogenic glycoside. When consumed, plant cell disruption releases enzymes that convert dhurrin into free hydrocyanic acid, or prussic acid. Ingested cyanide rapidly binds cytochrome oxidase enzymes, inhibiting cellular oxygen utilization and causing respiratory failure and sudden death in ruminants.

50. (C) Oxalates
Pearl Millet and Napier grass contain substantial concentrations of soluble oxalates. When ingested, oxalates combine with dietary calcium in the gastrointestinal tract to form insoluble calcium oxalate complexes. This prevents intestinal calcium absorption, leading to systemic hypocalcemia, osteodystrophy fibrosa, mineral imbalances, and potential urinary calculus formation in affected grazing livestock.

51. (B) Glucosinolates
Mustard oil cake contains glucosinolates, which enzymatic action converts into pungent thiocyanates, isothiocyanates, and nitriles. These anti-nutritional compounds impair feed intake due to bitterness and inhibit thyroid iodine uptake, causing goitrogenic effects, impaired metabolic efficiency, reduced milk yield, and decreased overall animal growth performance when fed in excessive dietary amounts.

52. (D) Phosphorus
Cereal grain byproducts like rice bran and wheat bran contain high concentrations of phosphorus, predominantly bound as phytate, while remaining naturally low in calcium. Unbalanced inclusion of these brans creates an inverted Calcium to Phosphorus ratio, leading to poor mineral utilization, nutritional secondary hyperparathyroidism, and skeletal bone resorption in livestock.

53. (A) Almost negligible oil (fat) content
Solvent extraction utilizes organic solvents such as hexane to extract oil from oilseeds, achieving efficient fat removal down to less than one percent residual fat. In contrast, mechanical expeller pressing leaves six to eight percent residual oil, making solvent-extracted meals lower in fat and higher in percentage crude protein content.

54. (B) I, III and IV only
Groundnut cake provides palatable crude protein. Linseed cake supplies mucilage providing laxative properties and producing shiny animal coats. Raw soybean meal contains heat-labile tryψn inhibitors requiring thermal processing. However, gossypol in cottonseed cake causes toxicity in monogastrics like poultry, whereas adult ruminants tolerate higher levels due to effective microbial ruminal detoxification.

55. (A) Supplementing minerals based on regional soil and fodder deficiency patterns
Soil mineral profiles vary regionally, directly determining mineral uptake in local fodder crops. Area Specific Mineral Mixtures are formulated after surveying regional soil and forage deficiencies, supplying only deficient minerals while omitting adequate ones. This targeted approach prevents mineral toxicities, avoids costly over-supplementation, and optimizes reproductive efficiency and milk production.

56. (C) 60 - 70%
Water is the predominant physiological constituent of animal tissues, accounting for sixty to seventy percent of total body weight in healthy adult cattle. Water acts as a universal solvent transporting nutrients and waste products, maintains cell turgidity and blood volume, facilitates enzymatic biochemical reactions, and plays a fundamental role in thermoregulation.

57. (B) Source of quick energy and feed binder
Sugarcane molasses is a byproduct of sugar refining containing high concentrations of fermentable sugars like sucrose, fructose, and glucose, providing a rapid source of ruminal energy. Additionally, its sticky consistency serves as an effective pellet binder, reducing feed dustiness, enhancing diet palatability, and preventing particle segregation in compound animal feeds.

58. (B) Rumen, Reticulum, Omasum, Abomasum
Ingested forage initially enters the rumen for microbial anaerobic fermentation, passing continuously back and forth into the honeycomb-structured reticulum for regurgitation and re-mastication. The digesta then moves into the omasum for water and volatile fatty acid absorption before reaching the abomasum, the glandular true stomach where enzymatic acid digestion occurs.

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48. Proper management and care during parturition is essential. In a normal calving process for a cow, what is the sequence of the three standard stages of labor?
(A) Expulsion of the placenta → Expulsion of the fetus → Preparatory stage
(B) Preparatory stage → Expulsion of the fetus → Expulsion of the placenta
(C) Expulsion of the fetus → Preparatory stage → Expulsion of the placenta
(D) Preparatory stage → Expulsion of the placenta → Expulsion of the fetus

49. Under normal physiological conditions, within what timeframe should the placenta (fetal membranes) be expelled after a cow delivers a calf?
(A) 30 to 45 minutes
(B) 4 to 12 hours
(C) 24 to 36 hours
(D) 48 to 72 hours

50. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): Colostrum must be fed to a newborn calf within the first two hours of birth.
Reason (R): Colostrum is rich in immunoglobulins that provide passive immunity, and the calf's intestinal ability to absorb these large proteins decreases rapidly after birth.
(A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A
(B) Both Assertion (A) and Reason (R) are true but R is not the correct explanation of A
(C) Assertion (A) is true but Reason (R) is false
(D) Assertion (A) is false but Reason (R) is true

51. Arrange the following steps of an animal breeding and sire evaluation programme in the correct chronological order from first to last:
1. Progeny Testing
2. Pedigree Selection
3. Performance Testing (Individual phenotypic evaluation)
(A) 1, 2, 3
(B) 2, 3, 1
(C) 3, 2, 1
(D) 2, 1, 3

52. What is the process called where the size of the uterus returns to its normal non-pregnant state after calving?
(A) Gestation
(B) Ovulation
(C) Superovulation
(D) Involution

53. Which of the following is an anomaly associated with twin births in cattle, where a female calf born co-twin to a male calf is typically sterile?
(A) Downer cow syndrome
(B) Nymphomania
(C) Free-martin
(D) Cryptorchidism

54. Consider the following statements regarding the National Artificial Insemination Programme (NAIP):
I. Free or subsidized AI services at the farmers' doorstep.
II. Use of semen strictly from disease-free, high-genetic-merit bulls.
III. Mandatory tagging and uploading of animal records to the INAPH database.
IV. Immediate replacement of all native breeds with 100% pure exotic animals.
Which of the above statement(s) is/are correct?
(A) I, II, and III only
(B) II, III, and IV only
(C) I, II, and IV only
(D) I, III, and IV only

55. INAPH is a comprehensive IT application developed by NDDB used heavily in national breeding programmes. What does INAPH stand for?
(A) Indian Network for Artificial Pregnancy and Health
(B) Institute of National Animal Physiology and Husbandry
(C) International Network for Animal Progress and Housing
(D) Information Network for Animal Productivity and Health

56. Which advanced reproductive technology involves collecting oocytes (eggs) from the ovaries of a donor animal and fertilizing them with sperm outside the body in a laboratory dish?
(A) In-Vitro Fertilization (IVF)
(B) Multiple Ovulation and Embryo Transfer (MOET)
(C) Artificial Insemination (AI)
(D) Estrus Synchronization

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48. (B) Preparatory stage → Expulsion of the fetus → Expulsion of the placenta
Parturition in dairy cattle naturally progresses through three distinct, chronological stages. The process begins with the preparatory stage, characterized by cervical dilation and uterine contractions. This is followed by the expulsion of the fetus through the birth canal, and concludes with the eventual detachment and expulsion of the fetal membranes.

49. (B) 4 to 12 hours
Under normal physiological conditions, a cow sheds her fetal membranes within four to twelve hours post-calving. Uterine contractions continue after calf delivery to release maternal-fetal caruncular connections. Retention beyond twelve hours is classified as retained placenta, requiring veterinary attention to avoid systemic infection, metritis, and subsequent decline in fertility.

50. (A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A
Newborn calves are born without circulating antibodies and must ingest colostrum within the first two hours of life to gain passive immunity. The neonatal calf's specialized intestinal epithelium absorbs large maternal immunoglobulins whole, but this absorption capacity declines rapidly after birth and closes completely within twenty-four hours.

51. (B) 2, 3, 1
Sire selection follows a logical progression of evaluation stages over time. Initial screening uses pedigree selection based on parental lineage and ancestral records. Promising young bulls then undergo performance testing to measure growth and phenotypic traits. Finally, top candidates enter progeny testing, evaluating daughter performance to confirm genetic superiority.

52. (D) Involution
Uterine involution is the physiological process following calving wherein the enlarged uterus, cervix, and endometrium regress back to their normal non-pregnant size and anatomical state. Taking approximately thirty to forty-five days, complete involution is necessary for restoring reproductive function, clearing uterine bacterial contamination, and preparing the animal for subsequent conception.

53. (C) Free-martin
A freemartin is a sterile female calf born twin to a male calf in cattle. Vascular anastomoses in the fused placenta allow exchange of male hormones and anti-Müllerian hormone into the female fetus. This hormonal exposure disrupts female reproductive tract development, resulting in testicular tissue formation, suppressed uterine development, and permanent infertility.

54. (A) I, II, and III only
The National Artificial Insemination Programme focuses on expanding doorstep AI services using high-quality semen from disease-free, high-genetic-merit bulls. The initiative enforces mandatory animal identification using ear tags linked to the INAPH database. It aims at genetic upgrading of local stock rather than replacing native breeds with pure exotics.

55. (D) Information Network for Animal Productivity and Health
INAPH stands for Information Network for Animal Productivity and Health, a specialized IT application designed by the National Dairy Development Board. It enables field technicians to record real-time data on animal identification, breeding events, nutrition, milk recording, and health services, supporting national livestock policy decisions and performance tracking.

56. (A) In-Vitro Fertilization (IVF)
In-Vitro Fertilization involves harvesting immature oocytes directly from donor cow ovaries, maturing them in specialized media, and fertilizing them with prepared spermatozoa inside a laboratory environment. The resulting embryos are cultured to the blastocyst stage before being transferred into synchronized recipient cows or cryopreserved, accelerating genetic multiplication from valuable females.

57. (C) In-Vitro Fertilization (IVF)
Ovum Pick Up is a minimally invasive ultrasound-guided transvaginal aspiration technique used to collect live oocytes directly from the ovarian follicles of donor cows. These retrieved oocytes serve as the foundational starting material for laboratory In-Vitro Fertilization, allowing continuous embryo production even from pregnant, young, or sub-fertile elite cattle.

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summer and winter farm seasons
(D) The statistical ratio of male to female calves born within a given calendar year

67. The trait of 'Heritability' indicates:
(A) The exact total number of somatic chromosomes an animal possesses
(B) The expected total lifecycle duration and longevity of the animal
(C) The proportion of phenotypic variation due to genetic factors
(D) The overall degree of natural resistance to troublesome ectoparasites

68. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): Inbreeding is generally discouraged in commercial dairy farming for milk production.
Reason (R): Continuous inbreeding leads to inbreeding depression, which causes a reduction in reproductive efficiency, vigor, and overall milk yield.
(A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A
(B) Both Assertion (A) and Reason (R) are true but R is not the correct explanation of A
(C) Assertion (A) is true but Reason (R) is false
(D) Assertion (A) is false but Reason (R) is true

69. If a dairy farmer wants to improve multiple traits simultaneously (e.g., milk yield, fat percentage, and udder conformation) and assigns a score to animals based on the relative economic value of each trait, which selection method is being used?
(A) Tandem selection
(B) Independent culling levels
(C) Selection index
(D) Natural selection

70. When evaluating semen at an AI centre, the 'Acrosome integrity' test is performed. The acrosome is located on which part of the sperm cell?
(A) The tip of the sperm tail
(B) The anterior part of head
(C) The central midpiece region
(D) The neck connecting section

71. The standard Artificial Insemination (AI) gun used widely in India is designed to hold:
(A) 5 ml glass ampoules
(B) 0.25 ml or 0.5 ml French straws
(C) 10 ml plastic tubes
(D) 1 ml syringes without needles

72. Select the correct sequential order of steps involved in the traditional Embryo Transfer Technique (ETT) in cattle:
(A) Superovulation → Insemination of donor → Recovery of embryos (Flushing) → Transfer to recipient
(B) Insemination of donor → Superovulation → Transfer to recipient → Recovery of embryos
(C) Recovery of embryos → Superovulation → Insemination of donor → Transfer to recipient
(D) Transfer to recipient → Recovery of embryos → Insemination of donor → Superovulation

73. Which of the following is NOT an advantage of Artificial Insemination (AI) over natural service?
(A) Rapid spread of superior genetics
(B) Elimination of venereal disease transmission
(C) Costly and requires technical expertise
(D) Overcomes size differences between males and females

74. Which of the following is considered an acceptable target for the number of 'services per conception' in a well-managed breeding herd?
(A) Greater than 4.0
(B) 3.0 to 3.5
(C) Less than 2.0
(D) 5.0 to 6.0

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75. In the context of the estrus cycle, what is the role of Gonadotropin-Releasing Hormone (GnRH)?
(A) It causes immediate regression of the corpus luteum
(B) It causes the smooth muscles of the uterus to contract during calving
(C) It maintains the pregnancy during the final trimester
(D) It stimulates the anterior pituitary gland to release FSH and LH

76. Match List I with List II regarding breeding terminology:
List I: (Breeding Terminology)
P. Sire
Q. Dam
R. Pedigree
S. Progeny
List II: (Definition)
1. Record of the ancestors of an animal
2. The offspring or descendant of an animal
3. The male parent

derived from native zebu cattle, avoiding high mortality in hot, humid climates.

29. (C) Karan Fries
The Karan Fries is a renowned dual-purpose crossbred cattle strain developed through interbreeding at the National Dairy Research Institute in Karnal, Haryana. Formed by crossing indigenous Tharparkar cows with exotic Holstein Friesian bulls, this breed exhibits impressive milk yield, high adaptability to local tropical conditions, and good early growth rates.

30. (D) Inbreeding
Inbreeding is the mating of animals that share closer genetic relationships than the average population average. While it increases genetic homozygosity and fixes desirable traits within lines, continuous practice leads to inbreeding depression, manifested as reduced fertility, lower calf survival rates, weakened immune systems, and diminished milk production across affected generations.

31. (A) Superior performance of crossbred offspring over parent average
Heterosis, commonly known as hybrid vigor, is the biological phenomenon wherein crossbred offspring exhibit phenotypic performance superior to the average of their purebred parents. This improvement is particularly pronounced in non-additive traits like fertility, vigor, growth rate, and disease resistance, forming the primary genetic advantage of crossbreeding commercial livestock species.

32. (A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A
Accurate pedigree records document the genetic lineage of individual animals across generations. Maintaining these records is crucial in selective breeding because it enables breeders to calculate estimated breeding values, select animals based on ancestral performance, avoid unintentional matings between related individuals, and effectively control inbreeding depression within commercial dairy populations.

33. (B) Ancestors (parents, grandparents) and performance records
A pedigree record documents an animal's ancestral heritage, detailing its parents, grandparents, and earlier generations alongside their respective production and reproductive metrics. Breeders analyze this genealogical data to evaluate genetic merit, predict performance transmission to progeny, select superior breeding stock, and construct planned mating systems that minimize accidental close-line inbreeding.

34. (A) Progeny testing
Progeny testing is the most reliable method for evaluating the true genetic merit of a dairy sire for sex-limited traits like milk production. By recording and analyzing the lactation performance of a large, unbiased sample of a bull's daughters, breeders accurately determine the sire's breeding value and select superior genetic stock.

35. (C) The bull must be disease-free and possess high proven genetic merit
Semen collection centers enforce rigorous selection criteria for breeding bulls to prevent disease transmission and optimize herd genetics. Candidates must possess high proven genetic merit for milk production traits and pass strict veterinary screenings, proving freedom from infectious venereal and systemic diseases such as brucellosis, tuberculosis, Johne's disease, and trichomoniasis.

36. (B) I, II, and III only
Selecting a superior breeding bull requires evaluating high genetic merit for economic traits, outstanding seminal quality parameters, and absolute freedom from infectious reproductive diseases. Sires do not need to be purebred exotics; high-performing indigenous or crossbred bulls tailored to local environmental conditions are frequently chosen under regional livestock breeding policies.

37. (C) Development and conservation of indigenous bovine breeds
The Rashtriya Gokul Mission is a national program aimed at conserving, upgrading, and developing indigenous bovine breeds. It focuses on enhancing genetic merit, increasing milk productivity, promoting elite bull mother farms, and establishing Gokul Grams, thereby protecting native cattle genetic resources while improving rural livestock livelihoods across the nation.

38. (B) Sahiwal
Sahiwal is a premier indigenous zebu dairy cattle breed originating from the Punjab region. Highly

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ANSWERS

1. (B) To improve the genetic potential and economic productivity of animals
Animal breeding in the dairy sector focuses on systematically modifying the genetic makeup of livestock populations across successive generations. By selecting genetically superior individuals for mating, breeders aim to enhance desirable economic traits such as milk yield, fat content, disease resistance, and reproductive efficiency, ultimately increasing farm profitability and sustainable livestock production performance.

2. (A) It limits the maximum number of females a single bull can mate with per year
Natural breeding relies on direct physical mating between a bull and cows, which significantly restricts the reproductive efficiency of high-value males. A bull can cover only a limited number of females annually, usually thirty to fifty, thereby slowing down genetic progress and preventing the widespread utilization of superior genetic traits across larger dairy herd populations.

3. (B) -196 °C
Liquid nitrogen is the standard refrigerant used for long-term cryopreservation of bull semen straws due to its extremely low boiling point of minus one hundred ninety-six degrees Celsius. At this temperature, metabolic processes within spermatozoa cease completely, allowing genetic material to remain viable and fertile for decades without physiological degradation or metabolic exhaustion.

4. (D) Glycerol
Glycerol serves as a vital intracellular cryoprotectant during the deep freezing of bovine spermatozoa. It penetrates the sperm cell membrane, reducing intracellular ice crystal formation during cooling. By lowering the freezing point and dehydrating the cell, glycerol prevents physical rupture of cellular membranes and acrosomes, ensuring structural integrity and post-thaw sperm motility.

5. (B) Thawing of semen → Loading the AI gun → Recto-vaginal insertion → Semen deposition
Successful artificial insemination in cattle requires a precise sequential protocol. Frozen semen straws must first be thawed in warm water to restore sperm motility. The straw is then loaded into an insemination gun, which is carefully inserted into the vagina and guided through the cervix using the recto-vaginal technique before depositing semen.

6. (A) 37 °C for 30 to 45 seconds
Rapid thawing of frozen semen straws in a water bath held at thirty-seven degrees Celsius for thirty to forty-five seconds ensures optimal recovery of sperm motility. This specific temperature and time combination minimizes thermal shock and prevents recrystallization of water within the cell, preserving the metabolic viability and membrane integrity of the spermatozoa.

7. (D) Body of the uterus near the cervix
Depositing semen into the uterine body immediately beyond the internal cervical os maximizes fertility in bovine artificial insemination. This anatomical site allows spermatozoa to travel equally into both uterine horns toward the oviducts, ensuring adequate sperm concentration at the fertilization site while avoiding mechanical injury to delicate uterine tissues during gun insertion.

8. (A) It increases the offspring yield from a genetically superior female
Multiple Ovulation and Embryo Transfer utilizes hormonal stimulation to cause valuable donor cows to produce multiple eggs per estrous cycle. Following insemination, the resulting embryos are flushed and transferred into surrogate mothers. This reproductive technology allows high-performing females to produce dozens of offspring annually, accelerating genetic gain within dairy cattle populations.

9. (C) I and II only
Silent heat, or subestrus, occurs when normal follicular development and ovulation take place without displaying noticeable external behavioral signs of estrus, such as standing to

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57. The 'Ovum Pick Up' (OPU) technique is an integral part of which advanced breeding method?
(A) Natural mating
(B) Sex-sorted semen production
(C) In-Vitro Fertilization (IVF)
(D) Routine Artificial Insemination

58. What is the recommended length of the 'dry period' (non-milking phase) for a dairy cow prior to her next calving, to ensure optimal udder repair and future milk yield?
(A) 15 to 20 days
(B) 60 to 90 days
(C) 120 to 150 days
(D) 0 days; the cow should be milked continuously

59. Match List I with List II regarding acts of parturition:
List I: (Species)
P. Cattle
Q. Sheep
R. Goat
S. Pig
List II: (Specific Term for Act of Parturition)
1. Lambing
2. Kidding
3. Farrowing
4. Calving
(A) P-4, Q-1, R-2, S-3
(B) P-3, Q-2, R-1, S-4
(C) P-4, Q-2, R-1, S-3
(D) P-1, Q-4, R-3, S-2

60. The practice of feeding extra high-quality concentrate feed to a pregnant cow during the last 6 to 8 weeks of gestation is known as:
(A) Creep feeding
(B) Steaming up
(C) Flushing
(D) Weaning

61. Immediately after the birth of a calf, it is crucial to manage the navel cord to prevent severe infections (joint ill/navel ill). What is the standard recommended practice?
(A) Wash it thoroughly with clean tap water and leave it open
(B) Apply cow dung over it to stop bleeding
(C) Tie it tightly and dip it in 7% tincture of iodine
(D) Cauterize it with a red-hot iron

62. Which of the following best describes 'Generation Interval' in the context of animal breeding?
(A) The average duration of time elapsed between two successive estruses
(B) The total length of time taken from conception to successful birth
(C) The average number of lactations a dairy cow completes in her lifetime
(D) The average age of parents when replacement offspring are born

63. Consider the following statements regarding the post-partum management of a dairy cow:
I. Provide lukewarm water and easily digestible feed like wheat bran mash immediately after calving.
II. Retained placenta should be pulled out manually with extreme force within 2 hours.
III. Monitor the cow for signs of milk fever, especially in high-yielding crossbreds.
Which of the above statement(s) is/are correct?
(A) I and II only
(B) II and III only
(C) I and III only
(D) I, II, and III

64. In a systematic breeding programme, what is the term used for the mating of completely unrelated animals of the same breed?
(A) Inbreeding
(B) Outcrossing
(C) Crossbreeding
(D) Species hybridization

65. The Central Herd Registration Scheme (CHRS) implemented by the Government of India primarily aims to:
(A) To register only exotic dairy animals imported directly from abroad
(B) To identify and register high-yielding indigenous cattle for breeding
(C) To identify, capture, and register stray cattle found in urban areas
(D) To evaluate and register only infertile animals designated for culling

66. The genetic gain in an animal breeding programme depends heavily on the 'Selection Differential'. What does this term signify?
(A) The superiority of selected animals over the overall population average
(B) The overall percentage of dairy animals culled from the herd due to disease
(C) The observed difference in milk yield between

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19. (B) 12 to 14 months
An optimal calving interval of twelve to fourteen months ensures maximum lifetime milk production and regular calf crop returns in crossbred dairy cattle. Maintaining this timeframe requires cows to conceive within eighty to one hundred ten days post-partum, balancing adequate recovery of uterine health with high reproductive performance and financial sustainability for farmers.

20. (D) Repeat breeder
A repeat breeder cow exhibits normal, regular estrous cycles and shows no detectable clinical abnormalities of the reproductive tract, yet fails to conceive after three or more successive artificial inseminations. This condition results from early embryonic death or fertilization failure, leading to extended calving intervals and substantial economic losses for dairy enterprises.

21. (C) Poor nutrition, energy deficit, and mineral deficiency
Nutritional deficiency is the primary cause of anestrus in tropical and subtropical dairy livestock. Negative energy balance, insufficient dietary protein, and acute shortages of essential micro-minerals such as phosphorus, copper, and cobalt suppress gonadotropin secretions. This hormone deficiency prevents ovarian follicular maturation, halting estrous cycles and causing prolonged periods of reproductive inactivity.

22. (B) Constant, intense, and irregular heat signs (Nymphomania)
Cystic ovarian disease occurs when mature follicles fail to ovulate and persist on the ovary, producing continuous or fluctuating levels of estrogen. Affected cows display nymphomania, characterized by frequent, irregular, and intense heat behavior, constant mounting of herd mates, elevated tailhead posture, and an inability to conceive, severely impairing herd breeding schedules.

23. (A) P-3, Q-4, R-2, S-1
Gestation lengths vary across livestock species based on biological characteristics. Cattle have a gestation period of two hundred eighty days, whereas buffaloes average three hundred ten days. Goats require approximately one hundred fifty days for fetal development, and sows feature a brief gestation of one hundred fourteen days, often remembered as three months, three weeks, and three days.

24. (A) Sterility
Sterility represents an absolute, permanent, and irreversible state of reproductive dysfunction in an animal, rendering it totally incapable of producing viable gametes or conceiving offspring. Unlike sub-fertility or temporary infertility, which can be corrected through medical or nutritional management, sterile animals cannot be successfully treated and are routinely culled from livestock herds.

25. (C) Progesterone
Progesterone is essential for establishing and maintaining pregnancy in domestic ruminants. Produced continuously by the functioning corpus luteum, it prepares the endometrial lining for conceptus implantation, suppresses uterine muscular contractions, prevents return to estrus by inhibiting gonadotropin secretion, and supports early embryonic nutrition, ensuring the continuation of gestation to full term.

26. (A) Holstein Friesian
The Holstein Friesian breed, originating from the Netherlands, is the premier exotic dairy cattle breed used globally and across India for crossbreeding native cattle. Prized for its unmatched capacity for milk yield per lactation, crossbred offspring carry high production potential, making them central to intensive milk production strategies in crossbreeding programs.

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27. (C) III only
Grading up is a long-term breeding strategy where non-descript or low-producing local females are repeatedly mated with purebred sires of a superior breed across successive generations. By the fifth or sixth generation, offspring inherit over ninety-six percent of the purebred sire's traits, effectively transforming the local population without requiring interbreeding between two distinct pure breeds.

28. (B) 50 to 62.5 percent
National animal breeding policies recommend maintaining exotic blood levels between fifty and sixty-two point five percent in crossbred cattle. This optimal range retains superior milk production potential from exotic breeds while ensuring sufficient disease resistance, heat tolerance, and environmental adaptability

be mounted. This reproductive phenomenon is particularly common in buffaloes and high-yielding dairy cows, requiring milk progesterone testing or rectal examination rather than visual observation for detection.

10. (A) X-bearing sperm contain slightly more DNA content than Y-bearing sperm
Sex-sorted semen technology relies on flow cytometry to separate spermatozoa based on nucleic acid mass differences. Bovine X-chromosomes contain approximately 3.8 percent more deoxyribonucleic acid than Y-chromosomes. Fluorescent dye binds proportionately to this genetic material, enabling high-speed laser sorting equipment to differentiate between male and female determining sperm with high statistical accuracy.

11. (D) Production of 90 percent or more female calves
Utilizing sex-sorted semen in dairy cattle breeding ensures that over ninety percent of resulting births yield female calves. This selective technology helps commercial dairy farmers generate replacement heifers efficiently while reducing unwanted male calves, thereby accelerating herd expansion, facilitating genetic selection for milk yield, and enhancing overall farm profitability and management efficiency.

12. (B) 21 days
The average duration of the bovine estrous cycle is twenty-one days, though a normal physiological range of eighteen to twenty-four days is widely recognized. This recurring reproductive cycle consists of follicular and luteal phases regulated by endocrine interactions between the hypothalamus, pituitary gland, ovaries, and uterus, preparing the cow for potential fertilization.

13. (C) Standing to be mounted and discharging clear stringy mucus
Standing to be mounted by other animals is the primary definitive behavioral indicator of estrus in cows. During this phase, elevated estrogen levels cause nervousness, increased vocalization, swelling of the vulva, and secretion of clear, viscous, stringy cervical mucus. Timely detection of these physical signs is crucial for proper artificial insemination scheduling.

14. (A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A
The AM-PM rule specifies that cows observed in heat during the morning should be inseminated during the evening, whereas those showing heat in the evening should be inseminated the following morning. Because ovulation occurs ten to fourteen hours after estrus ends, this timing allows sperm to undergo capacitation in the oviduct prior to egg release.

15. (D) Diestrus
Diestrus is the longest phase of the bovine estrous cycle, characterized by a fully functional corpus luteum. During this stage, the corpus luteum reaches maximum size and secretes large quantities of progesterone to prepare the uterus for embryonic implantation, maintain uterine quiescence, and inhibit the surge of gonadotropins required for new ovulations.

16. (B) 310 days
The average gestation period of domestic water buffaloes is approximately three hundred ten days, ranging from three hundred to three hundred twenty days depending on breed and environmental factors. This duration is significantly longer than the ten-month gestation typical of cattle, requiring tailored herd management strategies for calving intervals and transition cow care.

17. (B) 45 to 60 days
Per-rectal palpation is a practical field method for confirming pregnancy in cattle, routinely performed forty-five to sixty days post-insemination. Experienced veterinarians detect physiological indicators such as asymmetry of the uterine horns, slip of fetal membranes, presence of amniotic vesicles, and palpation of placentomes to accurately determine gestational status and manage reproduction.

18. (A) I, II, and III only
Breeding efficiency measures a dairy cow's reproductive performance and regularity. Parameters like calving interval, number of services required per conception, and days open directly reflect reproductive health and management success. Milk fat percentage, while an important economic trait for milk quality, measures compositional output rather than the physiological capability to conceive and bear offspring.

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valued across Northern India and Uttar Pradesh, Sahiwal cows exhibit impressive milk production, high milk fat content, strong resistance to tropical tick-borne diseases, and excellent heat tolerance, making them ideal for purebreeding and selective improvement programs.

39. (D) Burdizzo castrator method involving bloodless castration
The Burdizzo castrator is widely utilized for bloodless castration of scrub bulls in livestock management. This mechanical device crushes the spermatic cords and blood vessels supplying the testicles without severing the scrotum skin. The procedure leads to testicular atrophy, rendering stray or unwanted males infertile while minimizing surgical wound complications.

40. (C) 250 to 280 kg
Crossbred Holstein Friesian heifers should reach a body weight of two hundred fifty to two hundred eighty kilograms before initial artificial insemination. Achieving this weight threshold, usually around fifteen to eighteen months of age, ensures adequate anatomical frame size, reduces dystocia risks during first calving, and supports sustained milk production performance.

41. (A) P-3, Q-2, R-4, S-1
Hormones regulate distinct reproductive functions in livestock breeding. Estrogen induces behavioral estrus signs, whereas progesterone maintains pregnancy and suppresses estrus cycles. Oxytocin triggers smooth muscle contractions for milk let-down and labor, while Follicle Stimulating Hormone stimulates ovarian follicular growth, making it useful for superovulation protocols in embryo transfer.

42. (A) To synchronize ovulation for timed insemination without heat detection
The Ovsynch protocol utilizes controlled injections of Gonadotropin-Releasing Hormone and Prostaglandin F2-alpha to synchronize follicular recruitment and ovulation in dairy cattle. This systematic endocrine strategy enables timed artificial insemination at a fixed hour, completely eliminating the labor-intensive requirement for visual heat detection and improving reproductive management in commercial operations.

43. (D) Prostaglandin F2-alpha (PGF2α)
Prostaglandin F2-alpha is the physiological hormone responsible for luteolysis in farm animals. When administered during the luteal phase of the estrous cycle, it causes rapid regression of the corpus luteum, dropping blood progesterone levels sharply. This hormonal shift allows new follicular development, bringing the animal into estrus within two to five days.

44. (B) To detect estrus in females without completing fertile mating
A teaser bull is a surgically altered male, such as a vasectomized or penile-deviated bull, used in dairy management to detect cows in estrus. The teaser exhibits normal libido and mounting behavior to identify females in heat without depositing fertile sperm, greatly assisting farm staff in scheduling artificial insemination accurately.

45. (A) I and II only
Operating an artificial vagina for bull semen collection requires strict temperature and pressure regulation. Maintaining an internal temperature of forty-two to forty-five degrees Celsius and adequate air pressure simulates natural vaginal conditions, inducing ejaculation. Petroleum lubricants or non-spermicidal sterile gels must be used, as spermicidal compounds kill spermatozoa instantly.

46. (D) The overall vigor and motility of spermatozoa in thick semen
Mass activity evaluates the collective vigor and wave motion of spermatozoa in raw, unextended semen samples under low-power microscopic examination. Rated on a scale based on visible dark swirly currents, high mass motility reflects elevated sperm concentration and percentage of progressively motile cells, serving as a primary indicator of semen quality.

47. (A) Calving
Calving is the technical term defining the act of giving birth in bovine species. This physiological process concludes the gestation period, involving sequence steps that dilate the cervix, expel the calf through the birth canal, and shed the placenta. Proper supervision during calving ensures calf survival and prevents maternal reproductive complications.

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4. The female parent
(A) P-3, Q-4, R-1, S-2
(B) P-4, Q-3, R-1, S-2
(C) P-4, Q-3, R-2, S-1
(D) P-3, Q-4, R-2, S-1

77. Which method of selection involves establishing a minimum acceptable standard for each of several traits, and culling any animal that falls below the standard for any single trait?
(A) Systematic tandem selection
(B) Comprehensive selection index
(C) Independent culling levels
(D) Mass population selection

78. What is the primary purpose of maintaining accurate breeding records at the farm level?
(A) To satisfy local tax authorities and governmental regulatory bodies
(B) To reduce the total operational cost of roughage and concentrate feeding
(C) To eliminate the ongoing need for routine veterinary clinical treatments
(D) To identify less productive animals for culling and guide mating choices

79. When an embryo is flushed from a donor cow on Day 7 following AI, at what physiological stage is the embryo typically recovered?
(A) Early 2-cell division stage
(B) Early 4-cell division stage
(C) Morula to blastocyst stage
(D) Advanced fetus stage

80. The network of AI centres across Uttar Pradesh falls primarily under the administrative and technical guidance of which type of state entity?
(A) State Sugarcane Department and Agricultural Marketing Federation
(B) State Animal Husbandry Department and Livestock Board
(C) State Forest Department and Wildlife Conservation Directorate
(D) State Irrigation Department and Water Resources Management

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58. (B) 60 to 90 days
A recommended dry period of sixty to ninety days prior to anticipated calving allows necessary time for mammary gland involution, cellular repair, and regeneration of udder tissues. This non-lactating phase enables the cow to replenish essential nutrient reserves, support rapid late-stage fetal growth, and optimize milk yield during the subsequent lactation.

59. (A) P-4, Q-1, R-2, S-3
Distinct veterinary terminology describes the act of giving birth across farm animals. In cattle, the process is referred to as calving, while in sheep it is called lambing. Goats undergo kidding when delivering offspring, and pigs undergo farrowing when delivering a litter of piglets during parturition.

60. (B) Steaming up
Steaming up involves supplying extra energy-dense concentrate feed to pregnant cows during the final six to eight weeks of gestation. This nutritional practice builds nutrient reserves, supports rapid late-term fetal growth, adapts rumen microflora to high-concentrate feeds post-calving, and helps prevent metabolic disorders like ketosis while promoting high initial milk yields.

61. (C) Tie it tightly and dip it in 7% tincture of iodine
Proper umbilical management in newborn calves prevents ascending bacterial infections such as navel ill and joint ill. The umbilical cord should be ligated with sterile thread roughly two inches from the abdominal wall and dipped thoroughly in a seven percent tincture of iodine solution to desice the tissue and kill pathogens.

62. (D) The average age of parents when replacement offspring are born
Generation interval is defined as the average age of parents when their replacement progeny are born. Reducing this time metric accelerates the rate of annual genetic gain in breeding programs, enabling faster spread of desirable traits such as milk yield and disease resistance across successive livestock generations.

63. (C) I and III only
Post-partum management requires providing lukewarm water and digestible warm mash to comfort the cow and restore fluids. Monitoring high-yielding cows for hypocalcemia or milk fever is vital during early lactation. A retained placenta should never be pulled forcefully, as manual traction damages uterine tissues, causing severe infection and bleeding.

64. (B) Outcrossing
Outcrossing is the practice of mating unrelated purebred animals belonging to the same recognized breed. By selecting parents that share no common ancestors within four to six generations, breeders reduce the risk of inbreeding depression, restore physiological vigor, and introduce genetic variation while maintaining purebred status.

65. (B) To identify and register high-yielding indigenous cattle for breeding
The Central Herd Registration Scheme is a national initiative focused on identifying, assessing, and registering high-yielding indigenous cattle and buffalo breeds. By maintaining official performance records and herd books, the scheme locates elite genetic stock, encouraging systematic selective breeding to improve production traits and conserve native livestock genetic resources.

66. (A) The superiority of selected animals over the overall population average
Selection differential measures the average phenotypic difference between selected breeding individuals and the unselected population from which they were chosen. A larger selection differential indicates greater superiority of selected parents, which directly increases the rate of genetic progress achieved per generation for traits like milk yield and growth performance.

67. (C) The proportion of phenotypic variation due to genetic factors
Heritability expresses the proportion of total phenotypic variation among individuals in a population that is attributable to additive genetic differences. Ranging from zero to one, higher heritability values indicate that individual physical performance closely reflects underlying genetic worth, making phenotypic selection highly effective for traits like milk composition.

68. (A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A
Inbreeding is generally avoided in commercial dairy farming because continuous mating of

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without spoilage.
Reason (R): The moisture content in properly clarified ghee is practically negligible (less than 0.5%), which inhibits microbial growth.
Which of the following options is correct?
(A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).
(B) Both Assertion (A) and Reason (R) are true but Reason (R) is not the correct explanation of Assertion (A).
(C) Assertion (A) is true but Reason (R) is false.
(D) Assertion (A) is false but Reason (R) is true.

19. The first functional Milk Producers Cooperative Union in India was established in the state of Uttar Pradesh in the year 1938 at which of the following places?
(A) Lucknow
(B) Varanasi
(C) Kanpur
(D) Meerut

20. The historic 'Operation Flood', which aimed to modernize the dairy sector and make India self-sufficient in milk production, was officially launched in which year?
(A) 1965
(B) 1970
(C) 1981
(D) 1991

21. Select the correct sequential timeline for the three phases of the Operation Flood programme in India.
(A) Phase I: 1970-1981, Phase II: 1981-1985, Phase III: 1985-1996
(B) Phase I: 1965-1975, Phase II: 1975-1985, Phase III: 1985-1995
(C) Phase I: 1970-1980, Phase II: 1980-1990, Phase III: 1990-2000
(D) Phase I: 1975-1985, Phase II: 1985-1995, Phase III: 1995-2005

22. The National Dairy Development Board (NDDB), the premier policy-making body for dairying in India, is headquartered at:
(A) Karnal, Haryana
(B) New Delhi
(C) Anand, Gujarat
(D) Izzatnagar, Uttar Pradesh

23. A sample of milk has a Fat percentage of 4.0% and a Corrected Lactometer Reading (CLR) of 28 at 20 degrees Celsius. Using Richmond's simplified formula [SNF = (CLR/4) + (0.21 x Fat) + 0.36], calculate the approximate SNF percentage of the milk.
(A) 7.50 percent
(B) 8.20 percent
(C) 8.50 percent
(D) 9.00 percent

24. Match the common milk adulterants in List I with the rapid detection test or reagent in List II.
List I: (Adulterant)
P. Starch
Q. Urea
R. Neutralizers (Carbonates)
S. Cane Sugar
List II: (Detection test/reagent)
1. Rosalic Acid Test
2. Resorcinol Test
3. Iodine Solution Test
4. DMAC / Urease Test
Which of the following is the correct matching?
(A) P-3, Q-4, R-1, S-2
(B) P-4, Q-3, R-2, S-1
(C) P-3, Q-1, R-4, S-2
(D) P-2, Q-4, R-1, S-3

25. In the context of government and cooperative milk price-determination policy, what does the 'Two-Axis Pricing Policy' mean?
(A) Pricing milk by evaluating both Fat and Solid Not Fat (SNF) content
(B) Pricing milk based exclusively on total volume and transportation distance involved
(C) Pricing milk differently for rural agricultural producers and urban market consumers
(D) Pricing milk based strictly on the breed of the animal and its season of production

26. As per mandatory hygiene standards in the dairy industry, what is the primary purpose of 'Cleaning In Place' (CIP) systems in dairy plants?
(A) To mechanically sweep, wash, and sanitize the entire dairy farm housing floor
(B) To filter out somatic cells, sediment, and physical dirt from incoming raw milk
(C) To clean and sanitize pipelines and tanks without dismantling them
(D) To sterilize primary packaging material and containers prior to filling milk

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enables farmers to identify genetically inferior or infertile animals for culling while making informed, planned mating decisions that maximize herd productivity.

79. (C) Morula to blastocyst stage
When non-surgical embryo flushing is performed on Day 7 post-insemination in cattle, recovered embryos have developed to the late morula or early blastocyst stage. At this physiological phase, the spherical embryo remains unattached within the uterine lumen, enclosed by the zona pellucida, making it ideal for recovery, evaluation, and transfer.

80. (B) State Animal Husbandry Department and Livestock Board
Artificial insemination networks and livestock breeding infrastructure across Uttar Pradesh operate under the administrative oversight of the State Department of Animal Husbandry and Uttar Pradesh Livestock Development Board. These governmental bodies regulate breeding policies, manage semen distribution centers, implement national livestock missions, and provide field-level technical veterinary services.

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coagulate.
Which of the following options is correct?
(A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).
(B) Both Assertion (A) and Reason (R) are true but Reason (R) is not the correct explanation of Assertion (A).
(C) Assertion (A) is true but Reason (R) is false.
(D) Assertion (A) is false but Reason (R) is true.

54. The acronym AMUL represents one of the most successful dairy cooperative movements in the world. What does AMUL stand for?
(A) Asian Milk United League
(B) Amrut Milk Union Limited
(C) Anand Milk Union Limited
(D) Agriculture Milk United Limited

55. In the three-tier dairy cooperative structure implemented across India, which tier represents the apex body at the state level that handles marketing and brand management?
(A) Primary Village Dairy Cooperative Society
(B) State Dairy Federation
(C) District Cooperative Milk Producers Union
(D) National Dairy Development Board Apex Body

56. What was the primary strategic focus of Phase III (1985-1996) of the Operation Flood programme?
(A) Establishing the initial network of public model dairies across major metropolitan cities
(B) Importing high-yielding European dairy breeds to completely replace all indigenous cattle
(C) Introducing synthetic artificial milk manufacturing technologies across rural processing units
(D) Consolidating cooperatives, expanding processing, and achieving self-reliance

57. The massive capital required to launch Phase I of the Operation Flood programme was generated primarily through the sale of which commodities gifted by the World Food Programme (WFP) and European Economic Community (EEC)?
(A) Skimmed Milk Powder and Butter Oil
(B) Wheat and Rice
(C) Chemical Fertilizers and Tractors
(D) High-yielding fodder seeds and vaccines

58. Under the provisions of the government milk price-determination policy, a payment system that calculates the price of milk based on the quantity of Fat and the quantity of SNF is known to be equitable. Such a system heavily penalizes which unethical practice?
(A) Feeding green fodder instead of dry fodder
(B) Milking the animal twice a day instead of thrice
(C) Adulterating the milk with extraneous water
(D) Selling milk in the evening rather than the morning

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59. The National Cooperative Dairy Federation of India (NCDFI), which functions as the apex organization for the cooperative dairy sector, is headquartered in which state?
(A) Gujarat
(B) Uttar Pradesh
(C) Punjab
(D) Maharashtra

60. Match the milk quality testing apparatus in List I with its specific application in List II.
List I: (Apparatus)
P. Lactometer
Q. Butyrometer
R. Gerber Centrifuge
S. Richmond's Scale
List II: (Application)
1. Quick calculation of SNF percentage
2. Measurement of specific gravity
3. Holding the test sample during fat extraction
4. Mechanical separation of the fat column
Which of the following is the correct matching?
(A) P-2, Q-3, R-4, S-1
(B) P-1, Q-2, R-3, S-4
(C) P-4, Q-1, R-2, S-3
(D) P-2, Q-4, R-3, S-1

61. In the Gerber method for determining the fat content of milk, concentrated Sulphuric Acid is used. What is the specific gravity of the Sulphuric Acid required for this accurate test?
(A) 1.028 to 1.030
(B) 1.500 to 1.550
(C) 1.815 to 1.820
(D) 2.010 to 2.050

62. When conducting a milk quality test, a technician adds 10 ml of concentrated sulphuric acid, 10.75 ml of milk, and 1 ml of amyl alcohol into a specialized glass tube. Which test is the technician performing?

(D) Efficiency of the pasteurization process

9. Which of the following practices is highly discouraged as it negatively impacts clean milk production?
(A) Washing the udder with a mild antiseptic solution before milking
(B) Feeding dry, dusty roughage just before or during milking
(C) Tying the animal's tail during the milking process
(D) Discarding the first few streams of milk from each quarter

10. Consider the following stages of the organized milk distribution system:
1. Primary Village Dairy Cooperative Society
2. Milk Producer / Farmer
3. Dairy Processing Plant
4. District Milk Union / Chilling Centre
5. Urban Retail Outlet / Consumer

Which of the following options represents the correct sequential order from origin to consumption?
(A) 2, 1, 4, 3, 5
(B) 1, 2, 3, 4, 5
(C) 2, 4, 1, 3, 5
(D) 2, 1, 3, 4, 5

11. The widely successful 'Anand Pattern' of dairy cooperatives operates on a three-tier structure. What does the middle tier represent in this system?
(A) District Milk Producers Union
(B) Village Dairy Cooperative Society
(C) State Dairy Federation
(D) National Dairy Development Board

12. Which of the following best describes the primary function of a Milk Collection Centre at the village level?
(A) To pasteurize, package, and directly distribute fluid milk to urban consumers
(B) To process all surplus rural milk into long shelf-life products like powder
(C) To collect, test quality (Fat/SNF), measure, and temporarily hold raw milk
(D) To distribute fodder seeds, veterinary supplies, and equipment to villagers

13. To maintain the cold chain effectively and prevent bacterial multiplication, raw milk must be chilled immediately after collection to a temperature of:
(A) 4 degrees Celsius
(B) 10 degrees Celsius
(C) 15 degrees Celsius
(D) 0 degrees Celsius

14. The technical process in milk processing where the fat and SNF contents are adjusted to a predetermined legally prescribed standard is known as:
(A) Clarification
(B) Homogenization
(C) Standardization
(D) Fortification

15. In the High Temperature Short Time (HTST) method of pasteurization, milk is heated to what temperature and for how long?
(A) 63 °C for 30 minutes
(B) 72 °C for 15 seconds
(C) 135 °C for 2 seconds
(D) 85 °C for 5 minutes

16. Consider the following statements regarding milk processing techniques:
I. Pasteurization is designed to destroy all pathogenic microorganisms present in raw milk.
II. Homogenization prevents the formation of a cream line by physically breaking down fat globules.
III. Sterilization completely eliminates all microorganisms, including spores, providing a long shelf life.
IV. Clarification removes dissolved chemical adulterants like urea and neutralizers from milk.

Which of the above statements is/are correct?
(A) I, II, and III
(B) II, III, and IV
(C) I, III, and IV
(D) I, II, and IV

17. As per standard food safety regulations, table butter produced from cow or buffalo milk must contain a minimum milk fat percentage of:
(A) 60 percent
(B) 70 percent
(C) 80 percent
(D) 90 percent

18. Given below are two statements: one is labelled as Assertion (A) and the other as Reason (R).
Assertion (A): Ghee has a very long shelf life and can be stored at room temperature for months

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CHAPTER 30
Milk Production and Distribution

1. Which hormone is primarily responsible for the 'let-down' or ejection of milk from the alveoli in a dairy animal's udder?
(A) Oxytocin
(B) Prolactin
(C) Estrogen
(D) Progesterone

2. Given below are two statements: one is labelled as Assertion (A) and the other as Reason (R).
Assertion (A): Maintaining a calm and stress-free environment during milking is essential for complete milk let-down.
Reason (R): Stress triggers the release of adrenaline, which causes vasoconstriction and inhibits the action of oxytocin on the myoepithelial cells.
Which of the following options is correct?
(A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).
(B) Both Assertion (A) and Reason (R) are true but Reason (R) is not the correct explanation of Assertion (A).
(C) Assertion (A) is true but Reason (R) is false.
(D) Assertion (A) is false but Reason (R) is true.

3. Which of the following is considered the best indigenous dairy cow breed of India, known for its high milk yield and prominent navel flap?
(A) Sahiwal
(B) Tharparkar
(C) Red Sindhi
(D) Haryana

4. Match the constituents of milk in List I with their primary physical state in List II.
List I: (Constituent of milk)
P. Milk Fat
Q. Lactose
R. Casein
S. Whey Proteins
List II: (Physical state)
1. True solution
2. Emulsion
3. Colloidal suspension
4. Colloidal solution
Which of the following is the correct matching?
(A) P-2, Q-1, R-3, S-4
(B) P-1, Q-2, R-4, S-3
(C) P-3, Q-4, R-1, S-2
(D) P-2, Q-3, R-1, S-4

5. According to the Food Safety and Standards Authority of India (FSSAI) standards, what is the minimum prescribed standard for Fat and Solids-Not-Fat (SNF) in standardized milk?
(A) Fat 3.0%, SNF 8.5%
(B) Fat 4.5%, SNF 8.5%
(C) Fat 1.5%, SNF 9.0%
(D) Fat 6.0%, SNF 9.0%

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6. Which of the following is considered the best and most hygienic manual method of milking dairy animals to prevent teat injury?
(A) Stripping
(B) Knuckling
(C) Full hand milking (Fisting)
(D) Pinching

7. Consider the following statements regarding machine milking:
I. Milking machines extract milk by applying a continuous positive pressure on the teat end.
II. The pulsation unit regulates the rhythmic alternation between the milking phase and the massage phase.
III. The typical operating vacuum level for milking cows is maintained between 340 to 400 mm of Mercury (Hg).
Which of the above statements is/are correct?
(A) Only I and II
(B) Only II and III
(C) Only I and III
(D) All I, II, and III

8. In the context of clean milk production, the Somatic Cell Count (SCC) is an important indicator of which of the following?
(A) Udder health and sub-clinical mastitis
(B) Protein content in the milk
(C) Presence of adulterants like urea

27. According to official national livestock statistics, what is the approximate standing of Uttar Pradesh in terms of total national milk production?
(A) It ranks third, contributing about 10 percent
(B) It ranks first, contributing about 15.7 percent
(C) It ranks fifth, contributing about 7 percent
(D) It ranks second, behind Punjab, contributing about 12 percent

28. Which flagship scheme was launched by the Uttar Pradesh government to provide milk producers the facility to sell their milk at reasonable prices in villages through dairy co-operative societies?
(A) Kamdhenu Dairy Yojana
(B) Gokul Gram Yojana
(C) Swadeshi Gau Samvardhan Scheme
(D) Nand Baba Milk Mission

29. Consider the following statements regarding practical strategies for increasing milk productivity on a dairy farm:
I. Reducing the intercalving period to 12-14 months maximizes the lifetime milk production of a cow.
II. Feeding leguminous green fodder reduces the requirement for expensive protein concentrates.
III. Eliminating the dry period entirely between two lactations leads to higher milk yield in the subsequent lactation.
Which of the above statements is/are correct?
(A) Only I and II
(B) Only II and III
(C) Only I and III
(D) All I, II, and III

30. Which of the following national institutions acts as the nodal agency for implementing the Dairy Entrepreneurship Development Scheme (DEDS) which provides back-ended capital subsidy?
(A) State Bank of India (SBI)
(B) Indian Council of Agricultural Research (ICAR)
(C) National Bank for Agriculture and Rural Development (NABARD)
(D) Food Corporation of India (FCI)

31. Under the livestock insurance schemes protecting milk production, what mandatory procedure is applied to the insured milch animal to prevent false claims and identify the animal?
(A) Microchip insertion under the skin near the base of the tail
(B) Permanent hot iron or freeze branding on the thigh region
(C) DNA profiling and hair sample registration of the animal
(D) Applying a unique numbered ear tag

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32. The 'Dairy Processing and Infrastructure Development Fund' (DIDF) was primarily created to achieve which of the following objectives?
(A) To modernize processing plants and set up bulk milk coolers
(B) To distribute high-yielding milch animals free of cost to all marginal farmers
(C) To import high-yielding exotic cattle breeds directly from European countries
(D) To provide direct financial cash subsidies to urban consumers buying dairy milk

33. Under what brand name does the Pradeshik Cooperative Dairy Federation (PCDF) of Uttar Pradesh process, package, and market its milk and milk products?
(A) Sanchi
(B) Parag
(C) Saras
(D) Sudha

34. The phenomenal growth of the Indian dairy sector leading to self-sufficiency in milk production is termed the White Revolution. Who is universally recognized as the Father of the White Revolution in India?
(A) Dr. M. S. Swaminathan
(B) Dr. Verghese Kurien
(C) Dr. Norman Borlaug
(D) Dr. R. S. Paroda

35. During manual milking, the milker applies a defective technique involving bending the thumb against the teat, which leads to injury to the teat canal and increases the risk of mastitis. What is this defective method called?
(A) Knuckling
(B) Fisting
(C) Full hand milking
(D) Dry stripping

36. Given below are two statements: one is labelled as Assertion (A) and the other as Reason (R).
Assertion (A): Feeding a diet high in good quality roughage increases the fat percentage in the milk of a dairy cow.

Reason (R): High roughage fermentation in the rumen predominantly produces acetic acid, which is the primary precursor for milk fat synthesis.
Which of the following options is correct?
(A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).
(B) Both Assertion (A) and Reason (R) are true but Reason (R) is not the correct explanation of Assertion (A).
(C) Assertion (A) is true but Reason (R) is false.
(D) Assertion (A) is false but Reason (R) is true.

37. Which indigenous buffalo breed, native to the Agra and Etawah region of Uttar Pradesh, is highly prized for having the highest milk fat percentage (often exceeding 8-10%) among all buffalo breeds?
(A) Murrah
(B) Nili Ravi
(C) Surti
(D) Bhadawari

38. Match the type of milk in List I with its average specific gravity at 20 degrees Celsius in List II.
List I: (Type of Milk)
P. Cow Milk
Q. Buffalo Milk
R. Skim Milk
S. Milk Fat / Butterfat
List II: (Specific Gravity at 20°C)
1. 1.036
2. 1.032
3. 1.028
4. 0.930
Which of the following is the correct matching?
(A) P-3, Q-2, R-1, S-4
(B) P-2, Q-3, R-1, S-4
(C) P-3, Q-1, R-2, S-4
(D) P-1, Q-2, R-3, S-4

39. The distinct yellowish tint observed in the milk of cows (unlike the stark white milk of buffaloes) is primarily due to the presence of which pigment?
(A) Riboflavin
(B) Beta-carotene
(C) Xanthophyll
(D) Anthocyanin

40. Consider the following statements regarding the physical and chemical properties of normal fresh cow milk:
I. The pH of fresh cow milk typically ranges from 6.6 to 6.8, making it slightly acidic.
II. The freezing point of normal milk is slightly lower than that of water, typically around -0.54 degrees Celsius.
III. The boiling point of milk is slightly higher than that of water, typically around 100.17 degrees Celsius.
IV. Adulteration of milk with water increases its specific gravity above 1.030.
Which of the above statements is/are correct?
(A) I, II, and III
(B) II, III, and IV
(C) I, II, and III
(D) I, III, and IV

41. To ensure clean milk production, the udder of the animal must be washed and dried before milking. Which of the following is the most appropriate solution to use for sanitizing the udder?
(A) Mild potassium permanganate solution
(B) Highly concentrated nitric acid and chemical disinfectant mixture
(C) Commercial synthetic detergent powder solution dissolved in warm water
(D) Untreated pond water from local village reservoirs

42. Which of the following zoonotic diseases can spread directly from an infected dairy animal to the milker during manual milking if proper hygiene and cut-protection are not observed?
(A) Foot and Mouth Disease (FMD)
(B) Rinderpest
(C) Cowpox / Milker's nodules
(D) Black Quarter

43. Despite the growth of organized dairy processing, a significant portion of milk in India is still collected and distributed by the unorganized sector. Who constitutes the major part of this unorganized sector?
(A) Local milkmen (Dudhiyas) and sweet shops
(B) State Cooperative Dairy Federations operating in major administrative districts
(C) Private multinational dairy processing companies operating commercial plants
(D) District cooperative milk producers unions established under state federations

44. Identify the INCORRECT statement regarding the functioning of a Village Dairy Cooperative Society.
(A) It provides a regular, transparent, and dependable market for local milk producers
(B) It performs milk fat and SNF quality testing

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for every single batch supplied by the farmer
(C) It pays farmers promptly based on the exact quality parameters and weight of milk supplied
(D) It performs UHT sterilization and aseptic packaging at the village center

45. In modern dairy operations, a Bulk Milk Cooler (BMC) is utilized at the collection centre. The standard technical specification of a BMC requires it to cool the received raw milk to 4 degrees Celsius within what maximum time limit?
(A) 30 minutes
(B) 2.5 to 3 hours
(C) 6 to 8 hours
(D) 12 hours

46. The 'Cold Chain' in the dairy sector refers strictly to which of the following practices?
(A) Keeping dairy cows in modern air-conditioned sheds during extreme summer months
(B) Freezing raw milk completely into solid ice blocks for long distance transport
(C) Maintaining unbroken low temperatures from collection to final delivery
(D) Feeding only refrigerated cold water to milch animals immediately before milking

47. During the technical process of milk processing at a dairy plant, what is the specific objective of the 'Clarification' stage?
(A) To adjust the precise ratio of milk fat to solid-not-fat according to legal standards
(B) To eliminate all harmful pathogenic bacteria using controlled high heat treatment
(C) To break down large fat globules into smaller particles to prevent cream separation
(D) To remove dirt, cellular debris, and leucocytes using centrifugal force

48. Select the correct sequence of standard unit operations performed during the processing of fluid market milk in a commercial dairy plant.
(A) Clarification → Reception → Pasteurization → Homogenization → Packaging
(B) Reception → Clarification → Standardization → Pasteurization → Packaging
(C) Reception → Pasteurization → Clarification → Standardization → Packaging
(D) Standardization → Reception → Clarification → Packaging → Pasteurization

49. In the context of fluid milk safety and presentation, what is the primary purpose of passing pasteurized milk through a homogenizer under high pressure?
(A) To completely destroy all spore-forming bacteria present in raw fluid milk
(B) To break down fat globules so they remain evenly dispersed
(C) To significantly increase the overall solid-not-fat (SNF) percentage of the milk
(D) To blend synthetic essential vitamins into the milk for dietary fortification

50. Consider the following statements regarding the methods of pasteurization:
I. The Low Temperature Long Time (LTLT) method heats milk to 63 °C for 30 minutes.
II. The Ultra High Temperature (UHT) method heats milk above 135 °C for 1 to 2 seconds.
III. Pasteurization is legally defined to assure the destruction of the pathogen Mycobacterium tuberculosis.
Which of the above statements is/are correct?
(A) Only I and II
(B) Only I and III
(C) Only II and III
(D) All I, II, and III

51. While manufacturing ghee, the clarification process involves heating butter to evaporate moisture. According to standard food safety norms, the maximum permissible moisture content in finished ghee is:
(A) 5.0 percent
(B) 2.0 percent
(C) 0.5 percent
(D) 10.0 percent

52. Paneer is a popular dairy product in India. By what primary chemical action is paneer manufactured from milk?
(A) Rennet coagulation of chilled milk
(B) Fermentation using yeast cultures
(C) Acid coagulation of heated milk
(D) Slow churning of fermented curd

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53. Given below are two statements: one is labelled as Assertion (A) and the other as Reason (R).
Assertion (A): The preparation of curd (dahi) requires the addition of a starter culture to warm milk.
Reason (R): The starter culture contains Lactic Acid Bacteria (LAB) which ferment lactose into lactic acid, causing the milk proteins to

close relatives leads to inbreeding depression. This genetic phenomenon increases homozygous recessive alleles, causing significant declines in reproductive efficiency, calf survival, physical vigor, and overall milk yield, which harms farm profitability and herd health.

69. (C) Selection index
The selection index method evaluates multiple traits simultaneously by weighting each trait according to its economic importance, heritability, and genetic correlations. Individual animals receive a single numerical score combining performance data across parameters like milk yield, fat test, and udder health, allowing breeders to select top performers balanced for total economic value.

70. (B) The anterior part of head
The acrosome is a cap-like organelle located over the anterior region of the sperm cell head. Derived from the Golgi apparatus, it contains essential hydrolytic enzymes necessary for penetrating the outer protective layers of the ovum during fertilization. Evaluating acrosomal integrity ensures high fertility potential in frozen semen doses.

71. (B) 0.25 ml or 0.5 ml French straws
The standard artificial insemination gun widely utilized across India is specifically engineered to hold 0.25 milliliter mini or 0.5 milliliter medium French plastic straws. These precise, standardized semen straws fit securely inside the stainless steel barrel, enabling smooth hygienic deposition through the cow's cervix into the uterine body.

72. (A) Superovulation → Insemination of donor → Recovery of embryos (Flushing) → Transfer to recipient
Traditional Embryo Transfer Technology follows a systematic multi-step protocol. First, the donor female undergoes hormonal superovulation to release multiple eggs. Next, the donor is inseminated with high-quality semen. Seven days later, embryos are non-surgically recovered via uterine flushing, evaluated, and transferred into synchronized recipient surrogate females.

73. (C) Costly and requires technical expertise
Requiring specialized equipment, cold-chain maintenance, and skilled technical personnel represents a operational limitation and cost factor of artificial insemination rather than an advantage. Key benefits include rapid dissemination of high genetic merit, complete elimination of venereal disease transmission, and overcoming physical size mismatches during mating between males and females.

74. (C) Less than 2.0
Services per conception measures reproductive efficiency in dairy cattle management. In a well-managed breeding herd, a value of less than two total inseminations per confirmed pregnancy is targeted. Higher values indicate reproductive dysfunction, poor heat detection, sub-optimal insemination timing, or inferior semen handling practices, increasing operational costs.

75. (D) It stimulates the anterior pituitary gland to release FSH and LH
Gonadotropin-Releasing Hormone is synthesized by the hypothalamus and released in pulses into the hypophyseal portal system. It acts directly on the anterior pituitary gland, stimulating the synthesis and secretion of Follicle Stimulating Hormone and Luteinizing Hormone, which drive ovarian follicular maturation, estrogen production, and eventual ovulation in cattle.

76. (B) P-4, Q-3, R-1, S-2
Animal breeding uses precise terms to describe genetic lineages. A sire refers to the male parent of an animal, while a dam denotes the female parent. A pedigree represents the documented ancestral history across generations, and progeny refers to the offspring or descendants produced by specific parent animals.

77. (C) Independent culling levels
Independent culling levels is a selection method where minimum performance thresholds are established for multiple traits simultaneously. An individual animal must meet or exceed the cutoff standard for every single specified trait; falling below the minimum standard in any single parameter results in automatic culling, regardless of superior merit in other traits.

78. (D) To identify less productive animals for culling and guide mating choices
Maintaining accurate farm breeding records provides critical performance tracking required for efficient herd management. Detailed data regarding heat dates, inseminations, conception rates, calving intervals, and progeny performance

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(A) Alcohol Alizarin test for heat stability
(B) Phosphatase test for pasteurization efficiency
(C) Gerber test for milk fat
(D) Methylene Blue Reduction Test for bacterial load

63. Consider the following statements regarding milk pricing and testing policies:
I. Pricing milk solely on fat content disadvantages cow milk producers because cow milk naturally has less fat than buffalo milk.
II. The two-axis pricing system ensures farmers are paid for both the energy value (Fat) and the nutritional value (Protein/Lactose in SNF) of milk.
III. Adulteration with water decreases the specific gravity of milk.
IV. The presence of preservatives like formalin is permitted up to 2% in standardized milk under government rules.
Which of the above statements is/are correct?
(A) I, II, and III
(B) I, III, and IV
(C) II, III, and IV
(D) I, II, and IV

64. In rural cooperative societies, milk pricing policies traditionally favored measuring only fat percentage. Transitioning to the two-axis pricing policy was actively promoted by the government primarily to protect the economic interests of farmers rearing which type of animal?
(A) Crossbred and exotic cows
(B) Indigenous buffalo breeds such as Murrah and Bhadawari
(C) Dual-purpose goats and indigenous sheep breeds
(D) Desert draught animals such as camels

65. In the dairy industry, compliance with mandatory hygiene standards is critical. The presence of a high Coliform bacterial count in a pasteurized milk sample primarily indicates:
(A) Excess addition of synthetic liquid vitamins during the milk fortification process
(B) Post-pasteurization contamination, usually fecal
(C) Inadequate homogenization pressure applied during secondary milk processing steps
(D) Excessive over-heating of fluid milk during the standard pasteurization cycle

66. Under modern cleaning protocols in the dairy industry, what sequence of fluids is generally circulated through pipelines during Cleaning In Place (CIP)?
(A) Hot water → Acid solution → Hot water → Alkali solution → Cold water
(B) Cold water → Alkali detergent → Hot water → Acid solution → Clean water wash
(C) Milk → Cold water → Acid solution → Milk
(D) Steam → Alkali solution → Steam → Clean water wash

67. According to official agricultural production data, Uttar Pradesh holds a pre-eminent position in Indian dairying. Approximately what percentage of the total milk produced in India comes from Uttar Pradesh?
(A) 5 to 7 percent
(B) 15 to 16 percent
(C) 25 to 27 percent
(D) 35 to 40 percent

68. Historically, the structured cooperative movement in milk production in India saw its early roots in Uttar Pradesh. Which of the following is recognized as the first functional milk union established in UP in 1938?
(A) Allahabad Milk Producers Cooperative Union
(B) Kanpur Regional District Dairy Federation
(C) Lucknow Milk Union
(D) Meerut District Dudh Utpadak Sahkari Sangh

69. The 'Chief Minister Swadeshi Gau Samvardhan Yojana' in Uttar Pradesh provides subsidies to encourage farmers to purchase and rear which category of livestock?
(A) Exotic dairy cattle breeds such as Holstein Friesian and Jersey
(B) High-yielding Murrah and Nili Ravi buffalo breeds exclusively
(C) High-yielding commercial goat breeds for milk and meat production
(D) Indigenous cow breeds like Sahiwal, Tharparkar, and Gir

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70. In Uttar Pradesh, the 'Gokul Puraskar' is a state-level award given to encourage dairy farmers. What is the specific criterion for awarding the Gokul Puraskar?
(A) To the dairy farmer possessing the largest landholding dedicated to fodder cultivation
(B) To the local village headman for maintaining

the cleanest dairy cooperative building
(C) To the farmer supplying maximum milk to the cooperative union
(D) To the commercial dairy plant manager who achieves the lowest annual operational cost

71. A practical strategy for maximizing milk productivity over the lifetime of a dairy cow includes observing an optimal 'dry period' between two successive lactations. What is the scientifically recommended length of this dry period?
(A) 10 to 15 days
(B) 60 to 70 days
(C) 120 to 150 days
(D) 200 days

72. In nutrition management for increasing milk productivity, feeding urea to ruminants is a cost-effective strategy. Urea provides which essential nutritional component for the rumen microbes to synthesize protein?
(A) Digestible Crude Fiber
(B) Total Digestible Nutrients (TDN)
(C) Essential Fatty Acids
(D) Non-Protein Nitrogen (NPN)

73. The Dairy Entrepreneurship Development Scheme (DEDS) aims to generate self-employment. Under this scheme, what type of financial assistance is typically provided to the general category beneficiaries setting up a small dairy unit?
(A) 100% upfront grant for purchasing animals
(B) 25% back-ended capital subsidy on the project cost
(C) Free distribution of compound cattle feed for one year
(D) Interest-free loans with no principal repayment for 10 years

74. Under the National Livestock Mission's risk management component (Pashudhan Bima Yojana), ensuring protection of milk production through livestock insurance requires the farmer to immediately report the death of the insured animal to the veterinary officer and surrender which item to the insurance company?
(A) The complete tail switch along with skin samples of the deceased animal
(B) The official village cooperative milk collection passbook of the farmer
(C) The ear tag of the deceased animal
(D) The entire intact carcass of the deceased animal to the insurance office

75. Consider the following statements regarding the Dairy Processing and Infrastructure Development Fund (DIDF):
I. DIDF provides subsidized loans to cooperative milk unions to modernize and expand their milk processing facilities.
II. DIDF funds the installation of electronic milk adulteration testing equipment at the village level.
III. The nodal implementation agency managing the DIDF corpus is the Reserve Bank of India (RBI).
Which of the above statements is/are correct?
(A) Only I and II
(B) Only I and III
(C) Only II and III
(D) All I, II, and III

76. The Dairy Processing and Infrastructure Development Fund (DIDF) was announced by the Government of India to build an efficient milk procurement system. In which financial year was this fund officially established?
(A) 2005-06
(B) 2010-11
(C) 2017-18
(D) 2022-23

77. Modern milk marketing heavily relies on regional cooperative branding. While 'Saras' is the brand for Rajasthan and 'Sudha' for Bihar, which of the following is the official milk brand of the Uttar Pradesh state cooperative dairy federation?
(A) Verka
(B) Parag
(C) Aavin
(D) Nandini

78. As part of modern milk marketing and branding strategies, dairy companies package milk in aseptic multi-layered cartons (like Tetra Pak). This packaging is specifically designed to store which type of processed milk at room temperature for months?
(A) Raw untreated whole farm milk
(B) Standardized HTST pasteurized milk
(C) UHT treated milk
(D) Pasteurized low-fat double toned milk

79. The far-reaching effects of the White Revolution on the Indian dairy sector include several

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positive outcomes. Which of the following is an INCORRECT statement regarding its impact?

(A) India transformed from a milk-deficient nation into the world's largest milk producer.

(B) It eliminated a large network of exploitative middlemen by establishing direct cooperative linkages.

(C) It created millions of regular employment opportunities for marginal and landless rural households.

(D) The per capita availability of milk in India decreased drastically due to population explosion.

80. To commemorate the immense contribution of the architect of the White Revolution to Indian dairying, 'National Milk Day' is officially celebrated every year on which date?

(A) 1st June

(B) 16th October

(C) 26th November

(D) 23rd December

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ANSWERS

1. (A) Oxytocin
Oxytocin is a hormone secreted by the posterior pituitary gland that plays a vital role in animal lactation. During suckling or milking, tactile stimulation triggers its release into the blood stream. Oxytocin causes contraction of the myoepithelial cells surrounding the alveoli in the mammary gland, resulting in milk let down and ejection within a few minutes.

2. (A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).
A quiet and stress free environment during milking ensures maximum milk removal from dairy cows. When an animal experiences fear, pain, or distress, the adrenal glands secrete adrenaline. Adrenaline acts as an antagonist to oxytocin by causing blood vessel constriction and suppressing myoepithelial cell contraction, thereby inhibiting the natural let down process and reducing total yield.

3. (A) Sahiwal
Sahiwal is widely acknowledged as the premier indigenous dairy cattle breed of India, originating from the Montgomery region of modern Pakistan. It is characterized by a reddish brown coat, loose skin, and a distinct prominent navel flap. Sahiwal cows possess high heat tolerance, tick resistance, and the capability to yield significant volumes of milk under tropical environmental conditions.

4. (A) P-2, Q-1, R-3, S-4
Milk components exist in distinct physical states within the aqueous phase. Milk fat is present as a coarse emulsion of microscopic globules stabilized by a membrane. Lactose is dissolved completely, forming a true solution. Casein proteins form large micellar aggregates maintained in a colloidal suspension, whereas whey proteins exist in a finer colloidal solution throughout fluid milk.

5. (B) Fat 4.5%, SNF 8.5%
Standardized milk is defined by regulatory standards as milk whose fat and solids not fat levels have been chemically adjusted. According to food safety rules established in India, standardized milk must contain a minimum of four point five percent milk fat and eight point five percent solids not fat to ensure uniform nutritional quality for consumers across commercial markets.

6. (C) Full hand milking (Fisting)
Full hand milking, also known as fisting, is the most hygienic and effective manual milking technique. The milker grasps the entire teat with all fingers and squeezes against the palm, exerting uniform pressure. This method simulates natural calf suckling, prevents tissue injury to the teat lining, and ensures complete, rapid evacuation of milk from the udder.

7. (B) Only II and III
Milking machines operate by applying vacuum or negative pressure, rather than positive pressure, to extract milk from the teat cup. The pulsation unit regulates the rhythmic alternation between the expansion phase and the massage phase, preventing teat congestion. For cattle, operational vacuum levels are maintained between three hundred forty and four hundred millimeters of mercury.

8. (A) Udder health and sub-clinical mastitis
Somatic cells in raw milk consist primarily of white blood cells and epithelial cells sloughed from udder tissue. A low somatic cell count indicates a healthy udder and superior hygienic quality. An elevated count serves as a diagnostic marker for inflammatory responses, particularly subclinical mastitis, signaling reduced milk yield and compromised compositional quality.

9. (B) Feeding dry, dusty roughage just before or during milking
Clean milk production requires strict airborne dust management inside the milking area. Feeding dry or dusty roughages immediately prior to or during milking releases floating airborne particles and fungal spores. These particles easily settle into open milk pails, introducing physical impurities, bacteria, and off flavors, thereby contaminating the harvested milk and reducing shelf life.

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10. (A) 2, 1, 4, 3, 5
The organized milk supply chain follows a structured flow from farm to consumer. Milk originates from the individual producer or farmer, who delivers it to the primary village dairy cooperative society. From there, milk is collected and transferred to the district chilling centre, moved to the processing plant for pasteurization, and finally distributed to urban retail outlets.

11. (A) District Milk Producers Union
The Anand Pattern cooperative model is structured across three distinct operational tiers. The primary village society forms the base tier at the grassroots level, while the state federation forms the apex marketing tier. The middle tier consists of the District Cooperative Milk Producers Union, which owns processing plants, manages milk transport, and provides veterinary services.

12. (C) To collect, test quality (Fat/SNF), measure, and temporarily hold raw milk
A village milk collection centre serves as the primary contact point between rural dairy farmers and organized processing networks. Its essential operational role is to receive raw milk twice daily, measure milk volume or weight, perform rapid fat and solids not fat quality tests, and temporarily hold milk before dispatching it to chilling centres.

13. (A) 4 degrees Celsius
Rapid cooling of harvested raw milk is essential for preserving chemical freshness and preventing micro-organism growth. Raw milk leaves the cow udder at body temperature, which idealizes bacterial multiplication. Chilling raw milk to four degrees Celsius immediately after collection suppresses bacterial enzymatic activity and maintains microbiological stability throughout storage and transport to dairy processing plants.

14. (C) Standardization
Standardization is a core dairy technology process wherein the fat and solids not fat ratios of raw milk are adjusted to specified regulatory standards. This is achieved by adding skimmed milk to decrease fat concentration or adding cream to increase it, ensuring uniform nutritional composition and legal compliance prior to packaging and commercial distribution.

15. (B) 72 degrees Celsius for 15 seconds
High Temperature Short Time pasteurization is a continuous flow process designed to destroy pathogenic bacteria in liquid milk without compromising nutritional value. In this thermal method, fluid milk is rapidly heated to a minimum temperature of seventy-two degrees Celsius, held continuously for at least fifteen seconds, and then immediately chilled to four degrees Celsius.

16. (A) I, II, and III
Thermal pasteurization destroys pathogenic microbes, while homogenization breaks fat globules into microscopic particles to eliminate cream separation. Commercial sterilization applies intense heat to destroy all vegetative microorganisms and bacterial spores. However, centrifugal clarification removes insoluble suspended physical solids, dirt, and cellular debris rather than chemical adulterants like dissolved urea and neutralizers.

17. (C) 80 percent
Table butter is a high-fat dairy product manufactured by churning churned cream or pasteurized milk. Under national food quality and safety regulations, standard table butter must contain a minimum milk fat content of eighty percent by weight. The remaining percentage consists of moisture, milk solids not fat, and added common salt for flavor and preservation.

18. (A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).
Clarified butterfat, commonly known as ghee, possesses outstanding ambient stability and long shelf life compared to fluid milk products. During the clarification process, heat treatment evaporates almost all water content, reducing moisture levels below zero point five percent. This extremely low water activity prevents microbial proliferation and hydrolytic degradation, allowing storage without refrigeration.

19. (A) Lucknow
The cooperative milk marketing framework in India had early historical milestones in Uttar Pradesh. In 1938, the Lucknow Milk Producers Cooperative Union Limited was formally established as the first organized functional cooperative milk union in the country. It organized rural milk collection, established

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evaluation system immediately reflects lower testing values, heavily penalizing suppliers who engage in the fraudulent practice of adding extraneous water.

59. (A) Gujarat
The National Cooperative Dairy Federation of India is the national apex organization body representing cooperative milk federations across the country. Headquartered in Anand, Gujarat, NCDFI coordinates marketing activities, facilitates bulk procurement of dairy equipment and packaging, promotes national policies supporting smallholder farmers, and advocates for cooperative dairy growth throughout all Indian states.

60. (A) P-2, Q-3, R-4, S-1
Standard testing apparatuses measure distinct dairy quality parameters. A lactometer measures specific gravity to assess milk purity. A butyrometer is a calibrated glass tube used to hold milk during chemical fat extraction. A Gerber centrifuge mechanically spins samples to isolate fat columns, while Richmond's scale enables rapid mathematical estimation of solids not fat.

61. (C) 1.815 to 1.820
The Gerber method determines milk fat percentage by digesting non-fat constituents with concentrated sulphuric acid. For accurate analytical results, the sulphuric acid used must have a specific gravity strictly between one point eight one five and one point eight two zero at twenty degrees Celsius, ensuring complete digestion of proteins without charring the fat.

62. (C) Gerber test for milk fat
Combining ten milliliters of concentrated sulphuric acid, ten point seven five milliliters of raw milk, and one milliliter of amyl alcohol inside a butyrometer tube defines the Gerber test procedure. Sulphuric acid dissolves protein membranes to liberate fat, while amyl alcohol facilitates sharp separation of the clear fat column during centrifugation for volumetric measurement.

63. (A) I, II, and III
Fat-only pricing disadvantages cow milk producers because cow milk naturally contains lower fat content than buffalo milk. The two-axis pricing system provides fair compensation for both fat and non-fat milk solids. Adding water dilutes milk solids, lowering specific gravity. Conversely, adding chemical preservatives like formalin into market milk is strictly illegal under food safety regulations.

64. (A) Crossbred and exotic cows
Traditional fat-based pricing systems heavily favored high-fat buffalo milk, financially penalizing farmers rearing crossbred and exotic cows whose milk features lower fat percentages but rich non-fat solids. Transitioning to two-axis pricing ensured fair remuneration for cow milk based on solids not fat, encouraging adoption of high-yielding crossbred and exotic dairy cattle breeds.

65. (B) Post-pasteurization contamination, usually fecal
Coliform bacteria are heat-sensitive organisms that are completely killed during standard thermal pasteurization. The presence of significant coliform counts in pasteurized milk indicates secondary post-pasteurization contamination. This typically stems from unsterilized filling equipment, contaminated packaging materials, poor plant hygiene, or improper handling after thermal processing prior to final consumer packaging.

66. (B) Cold water → Alkali detergent → Hot water → Acid solution → Clean water wash
Cleaning In Place follows a precise operational cycle to sanitize processing circuits. A preliminary cold water rinse flushes loose milk residue. An alkaline detergent wash saponifies fats and dissolves organic proteins. A warm water rinse removes detergent, followed by an acid wash to dissolve mineral deposits, and a final clean water rinse.

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67. (B) It ranks first, contributing about 15.7 percent
According to official national livestock census data, Uttar Pradesh occupies the top position among Indian states in total milk production. Accounting for approximately fifteen to sixteen percent of the nation's total output, the state plays a vital role in national food security, rural employment, and the overall socio-economic development of farming communities.

68. (C) Lucknow Milk Union
The Lucknow Milk Union, established in 1938 in Uttar Pradesh, holds the distinction of being the

like berseem or cowpea reduces concentrate feed costs by providing high-quality digestible protein. Conversely, eliminating the dry period prevents essential mammary tissue regeneration, severely diminishing milk production in the subsequent lactation.

30. (C) National Bank for Agriculture and Rural Development (NABARD)
The Dairy Entrepreneurship Development Scheme is implemented to encourage self-employment and create modern dairy infrastructure in rural areas. The National Bank for Agriculture and Rural Development serves as the nodal agency responsible for administering back-ended capital subsidies through commercial and regional rural banks to eligible entrepreneurs setting up small dairy units.

31. (D) Applying a unique numbered ear tag
Livestock insurance schemes require positive, tamper-proof identification of insured milch animals to facilitate claims processing and prevent fraudulent activity. Fixing a unique numbered polyurethane ear tag into the animal's ear pinna establishes official registration, linking individual animal health and ownership records directly with insurance policies and veterinary field inspection reports.

32. (A) To modernize processing plants and set up bulk milk coolers
The Dairy Processing and Infrastructure Development Fund was established to modernize aging milk processing plants and strengthen rural chilling infrastructure. It provides concessional loan financing to cooperative dairy federations to set up bulk milk coolers, expand processing capacity, install milk powder production facilities, and ensure high quality milk collection throughout rural procurement centers.

33. (B) Parag
The Pradeshik Cooperative Dairy Federation of Uttar Pradesh markets its pasteurized fluid milk and dairy products under the popular brand name Parag. Established to safeguard producer interests and deliver pasteurized milk to urban households, Parag operates state processing plants, chilling centres, and retail booths, serving as a trusted brand in northern India.

34. (B) Dr. Verghese Kurien
Dr. Verghese Kurien is universally recognized as the Father of the White Revolution in India. As the visionary architect of Operation Flood and founding chairman of the National Dairy Development Board, he empowered millions of smallholder dairy farmers through cooperative organization, making India self-reliant and the top milk producing country in the world.

35. (A) Knuckling
Knuckling is a faulty manual milking method where the milker bends the thumb against the teat base while squeezing with fingers. This improper technique creates concentrated physical pressure on sensitive teat tissues, causing structural pain, micro trauma to the teat sphincter, and tissue inflammation, which increases susceptibility to bacterial infection and mastitis.

36. (A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).
Ruminant digestion of structural carbohydrates present in dietary fiber produces volatile fatty acids inside the rumen. Microbial fermentation of roughage generates acetic acid as the main end product. Acetic acid is absorbed into the blood and transported to mammary glands, serving as the chief precursor for de novo milk fat synthesis.

37. (D) Bhadawari
The Bhadawari buffalo is a renowned indigenous breed native to the Ravines of the Yamuna and Chambal rivers in Agra and Etawah districts of Uttar Pradesh. Characterized by a copper colored coat and wedge shaped body, Bhadawari buffalo milk is internationally acclaimed for possessing an extraordinarily high fat content, frequently ranging from eight to thirteen percent.

38. (A) P-3, Q-2, R-1, S-4
Specific gravity measures milk density relative to water at twenty degrees Celsius. Pure fat has a low specific gravity of zero point nine three zero. Normal cow milk has a specific gravity of one point zero two eight, buffalo milk averages one point zero three two, and skim milk exhibits a higher density of one point zero three six.

39. (B) Beta-carotene
The characteristic yellow tint in cow milk is primarily caused by beta-carotene, a fat-soluble carotenoid pigment synthesized by green plants.

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processing facilities, and structured distribution to protect smallholder farmers from middleman exploitation.

20. (B) 1970
Operation Flood was officially launched in 1970 under the guidance of the National Dairy Development Board. Designed as the world's largest dairy development initiative, it linked rural milk producers with urban consumers through a nation wide grid. This mega project transformed India from a milk-deficient nation into the world's largest producer of milk.

21. (A) Phase I: 1970-1981, Phase II: 1981-1985, Phase III: 1985-1996
Operation Flood was executed in three progressive phases to establish a robust national milk grid. Phase I operated from 1970 to 1981, laying foundational infrastructure and urban dairy outlets. Phase II ran from 1981 to 1985, expanding coverage across rural outlets. Phase III spanned 1985 to 1996, focusing on institutional consolidation and research advancement.

22. (C) Anand, Gujarat
The National Dairy Development Board was founded in 1965 to replicate the success of the Anand dairy cooperative model nationwide. Headquartered in Anand, Gujarat, this apex statutory body formulates policies, finances dairy infrastructure, and implements national developmental projects. It plays a pivotal role in strengthening smallholder livestock livelihoods and modernizing milk processing systems across India.

23. (B) 8.20 percent
Richmond's formula provides a standardized mathematical relationship to estimate solids not fat using fat content and corrected lactometer readings. Substituting a corrected lactometer reading of twenty-eight and four percent fat into the formula gives seven plus zero point eight four plus zero point three six, which equals exactly eight point two zero percent.

24. (A) P-3, Q-4, R-1, S-2
Chemical tests detect illegal adulterants in raw milk samples. Iodine solution reacts with starch to produce a characteristic blue color. DMAC or urease reagents identify added urea through colorimetric changes. Rosalic acid test detects neutralizing agents like sodium carbonates, whereas the resorcinol test specifically detects added cane sugar by producing a deep red reaction product.

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25. (A) Pricing milk by evaluating both Fat and Solid Not Fat (SNF) content
The Two-Axis Pricing Policy is an equitable milk valuation framework adopted by dairy cooperatives. Under this system, milk payment is calculated independently based on both its fat content and solids not fat content. This policy prevents economic discrimination against cow milk, which naturally has lower fat, and deters milk dilution or synthetic adulteration.

26. (C) To clean and sanitize pipelines and tanks without dismantling them
Cleaning In Place is an automated method of cleaning internal surfaces of processing equipment, tanks, and pipe circuits without dismantling the machinery. By circulating detergent solutions, acid rinses, and hot water through closed circuits at controlled velocity, the system effectively removes organic milk deposits, mineral stones, and microorganisms while maintaining high operational hygiene standards.

27. (B) It ranks first, contributing about 15.7 percent
Uttar Pradesh is the premier milk producing state in India, contributing approximately fifteen point seven percent to the total national milk output. Supported by a vast bovine population consisting of indigenous cattle, crossbred cows, and high-yielding buffalo breeds, the state plays a fundamental role in driving national livestock production and sustaining rural economic livelihoods.

28. (D) Nand Baba Milk Mission
The Nand Baba Milk Mission is a key initiative launched by the Uttar Pradesh government to empower rural milk producers. The scheme focuses on organizing dairy cooperative societies at the village level, enabling farmers to sell milk at fair prices, providing modern infrastructure, improving indigenous cattle breeds, and enhancing overall milk productivity across the state.

29. (A) Only I and II
Maintaining an optimal intercalving interval of twelve to fourteen months maximizes lifetime milk yield and reproduction efficiency in dairy cattle. Incorporating leguminous green fodder

49. (B) To break down fat globules so they remain evenly dispersed
Homogenization is a mechanical process in which liquid milk is forced under high pressure through fine orifice valves. This shearing action breaks large fat globules into microscopic droplets less than two micrometers in diameter. Reducing fat globule size prevents cream layer separation, improves milk viscosity, and ensures uniform fat distribution throughout storage.

50. (D) All I, II, and III
Pasteurization methods are calibrated to guarantee public health safety. The Low Temperature Long Time method heats milk to sixty-three degrees Celsius for thirty minutes. The Ultra High Temperature process heats milk above one hundred thirty-five degrees Celsius for two seconds. Historically, pasteurization parameters were legally established to destroy Mycobacterium tuberculosis, the most heat-resistant non-spore-forming pathogen.

51. (C) 0.5 percent
Ghee is manufactured by boiling butter or cream to evaporate water and develop characteristic caramelized aromas. Mandatory food quality standards prescribe that final clarified ghee must contain no more than zero point five percent moisture by weight. Restricting moisture content prevents hydrolytic rancidity and inhibits bacterial proliferation, ensuring extended shelf life at ambient storage temperatures.

52. (C) Acid coagulation of heated milk
Paneer is an unripened indigenous cheese produced by the thermal acid coagulation of whole milk. Milk is heated to approximately eighty-five to ninety degrees Celsius and then treated with organic acids such as citric acid or lactic acid. Lowering the pH causes casein proteins to precipitate out of solution, forming a coagulated curd that is pressed.

53. (A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).
Preparing curd or dahi involves inoculating warm pasteurized milk with a starter culture containing specific Lactic Acid Bacteria species. These beneficial bacteria metabolize milk lactose into lactic acid during incubation. The resulting surge in acidity lowers milk pH to the isoelectric point of casein, causing protein gelation and forming a smooth fermented curd network.

54. (C) Anand Milk Union Limited
AMUL stands for Anand Milk Union Limited, a cooperative dairy movement founded in 1946 in Anand, Gujarat. Formed under the leadership of Tribhuvandas Patel and Dr. Verghese Kurien to protect dairy farmers against middleman exploitation, AMUL pioneered the cooperative model that empowered smallholders, achieved commercial success, and spearheaded India's national White Revolution.

55. (B) State Dairy Federation
The three-tier Anand Pattern cooperative system comprises village cooperative societies at the base level and district producer unions at the middle level. The top tier is represented by the State Dairy Federation, which serves as the apex body responsible for state wide marketing, brand management, product distribution, centralized policy planning, and interstate trade.

56. (D) Consolidating cooperatives, expanding processing, and achieving self-reliance
Phase III of Operation Flood focused on consolidating gains achieved in earlier phases. Implemented between 1985 and 1996, it expanded modern processing capacity, strengthened animal health services, upgraded artificial insemination networks, and institutionalized rural cooperative management, ultimately transforming India into a self-reliant producer capable of meeting national fluid milk demand without commodity imports.

57. (A) Skimmed Milk Powder and Butter Oil
The initial capital required to fund Phase I of Operation Flood was generated through international commodity aid. The European Economic Community and World Food Programme donated surplus skimmed milk powder and butter oil. The National Dairy Development Board recombined and sold these commodities in urban markets, using generated revenues to build dairy processing plants.

58. (C) Adulterating the milk with extraneous water
An equitable milk pricing structure calculates payments based on measured quantities of both fat and solids not fat components. Because diluting milk with water reduces total solid concentrations per unit weight, a two-axis

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Cows absorb dietary beta-carotene from forage and pass it unaltered into milk fat globules. In contrast, buffaloes efficiently convert dietary beta-carotene into colorless vitamin A in the intestinal mucosa, resulting in distinctly white milk.

40. (C) I, II, and III
Fresh cow milk is slightly acidic with a pH between six point six and six point eight. Dissolved solutes give milk a freezing point around minus zero point five four degrees Celsius and a boiling point of one hundred point seventeen degrees. Adding extraneous water dilutes these solids, decreasing specific gravity below normal levels.

41. (A) Mild potassium permanganate solution
Washing and sanitizing udder tissues before milking is a core hygienic practice in clean milk production. A mild, diluted solution of potassium permanganate acts as a safe, effective antiseptic wash that reduces microbial loads on teat skin without causing chemical irritation or tissue damage, preventing raw milk contamination during the milking process.

42. (C) Cowpox / Milker's nodules
Cowpox is a viral zoonotic disease that affects the skin of bovine udders and teats. During manual milking, the parapoxvirus or orthopoxvirus can directly transfer from infected animal teats to small abrasions or cut skin on human hands, resulting in localized cutaneous skin lesions commonly referred to as milker's nodules.

43. (A) Local milkmen (Dudhiyas) and sweet shops
The unorganized milk marketing sector in India comprises traditional intermediaries, primarily unorganized local milkmen, traditional milk vendors known as dudhiyas, and local sweet makers or halwais. These informal actors collect unpasteurized raw milk directly from rural farm households and market it locally without systematic pasteurization, quality testing, or standardized cold chain logistics.

44. (D) It performs UHT sterilization and aseptic packaging at the village center
Village dairy cooperative societies are established to collect raw milk, measure volume, perform basic testing, and chilling before dispatch. Complex thermal processing technologies such as Ultra High Temperature sterilization and sterile aseptic carton packaging require specialized capital-intensive industrial plants. Consequently, high temperature sterilization processes are conducted at central regional processing dairies, not at village collection centers.

45. (B) 2.5 to 3 hours
Bulk Milk Coolers are refrigerated holding tanks installed at village collection centers to maintain raw milk quality. Standard technical guidelines mandate that a Bulk Milk Cooler must rapidly reduce the temperature of freshly harvested raw milk from ambient conditions to four degrees Celsius within two point five to three hours to halt microbial growth.

46. (C) Maintaining unbroken low temperatures from collection to final delivery
The cold chain in dairying represents an uninterrupted temperature-controlled logistics network. It requires keeping raw and processed milk continuously chilled, typically at or below four degrees Celsius, from initial farm collection through bulk chilling, transportation in insulated tankers, plant storage, and retail distribution, preventing bacterial proliferation and product spoilage, ensuring safety for ultimate consumers.

47. (D) To remove dirt, cellular debris, and leucocytes using centrifugal force
Centrifugal clarification is a physical purification step performed immediately after milk reception in dairy processing plants. By spinning raw milk at high rotational speeds, centrifugal force separates suspended high-density insoluble particles such as environmental dirt, udder epithelial cells, somatic leucocytes, and mucus, producing clean milk prior to homogenization and pasteurization.

48. (B) Reception → Clarification → Standardization → Pasteurization → Packaging
Commercial processing of market milk follows a logical technical sequence. Raw milk is accepted at reception, followed by centrifugal clarification to eliminate insoluble physical impurities. Next, fat and solids not fat levels are standardized to legal requirements. The standardized milk undergoes pasteurization to destroy pathogens, followed by immediate cooling and automated aseptic packaging.

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first functional cooperative milk union organized in India. Created to protect rural milk producers from exploitation by private middlemen, it laid the foundation for systematic milk procurement, quality control testing, and organized urban dairy distribution.

69. (D) Indigenous cow breeds like Sahiwal, Tharparkar, and Gir
The Chief Minister Swadeshi Gau Samvardhan Yojana was launched in Uttar Pradesh to promote indigenous cattle genetics and enhance milk production. The scheme offers financial subsidies to farmers purchasing high-yielding indigenous cow breeds such as Sahiwal, Tharparkar, and Gir, aiming to preserve native germplasm, boost rural income, and increase local milk availability.

70. (C) To the farmer supplying maximum milk to the cooperative union
The Gokul Puraskar is a prestigious state-level award instituted by the Uttar Pradesh government to encourage cooperative milk production. It honors the individual dairy farmer who supplies the highest total quantity of milk to a primary milk producers cooperative society during a specified financial year, fostering healthy competition and cooperative growth.

71. (B) 60 to 70 days
A non-lactating dry period of sixty to seventy days between lactations is essential for optimizing long-term milk productivity. This period permits the involution and structural regeneration of damaged secretory epithelial cells in the udder. Furthermore, it allows the pregnant animal to restore body nutrient reserves and support rapid fetal development before calving.

72. (D) Non-Protein Nitrogen (NPN)
Urea serves as a low-cost non-protein nitrogen supplement in ruminant feed rations. Rumen microorganisms hydrolyze urea into ammonia using urease enzymes. Microbes synthesize bacterial protein from this liberated nitrogen and available dietary energy, which passes into the abomasum and small intestine, meeting the animal's amino acid requirements for milk synthesis.

73. (B) 25% back-ended capital subsidy on the project cost
Under the Dairy Entrepreneurship Development Scheme, eligible general category beneficiaries setting up small modern dairy farms receive a twenty-five percent back-ended capital subsidy on total project cost. Channelized through NABARD, this financial subsidy is held in a bank reserve account and adjusted against loan repayment, reducing borrowing costs for entrepreneurs.

74. (C) The ear tag of the deceased animal
To process livestock insurance claims upon the death of an insured milch animal, official procedures mandate surrendering the animal's intact ear tag. Returning the unique numbered tag to the insurance company along with a post-mortem certificate from a licensed veterinary officer verifies positive identification and prevents fraudulent claims for false losses.

75. (A) Only I and II
The Dairy Processing and Infrastructure Development Fund provides concessional financing to cooperative milk unions to modernize processing facilities and establish bulk milk chilling units. It also funds installation of electronic milk testing and adulteration detection equipment at collection centers. The fund is managed by NABARD and NDDB, rather than the Reserve Bank of India.

76. (C) 2017-18
The Dairy Processing and Infrastructure Development Fund was officially set up during the financial year 2017-18 by the Government of India. With an initial corpus managed through NABARD, the fund aims to finance modern milk processing infrastructure, enhance chilling capabilities, and create additional processing capacity across cooperative milk unions nationwide.

77. (B) Parag
Parag is the official registered brand name used by the Pradeshik Cooperative Dairy Federation of Uttar Pradesh to market its pasteurized fluid milk and processed milk products. Operating through regional cooperative unions, Parag produces pasteurized milk, ghee, paneer, and butter, catering to urban consumers while ensuring remunerative prices for rural dairy farmers.

78. (C) UHT treated milk
Multi-layered aseptic carton packaging, such as Tetra Pak, is specifically engineered to package

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Ultra High Temperature processed milk. High heat treatment destroys all vegetative microbes and bacterial spores. When combined with multi-layer barrier packaging that protects against light and oxygen, UHT milk remains commercially sterile and shelf-stable at room temperature for several months.

79. (D) The per capita availability of milk in India decreased drastically due to population explosion.
Operation Flood dramatically increased milk production across India, transforming the nation from a milk deficit importer to the world's leading milk producer. Rather than declining, per capita daily milk availability increased substantially over the decades, rising from approximately one hundred seven grams per day in 1970 to over four hundred grams per day.

80. (C) 26th November
National Milk Day is celebrated across India annually on November twenty-sixth to commemorate the birth anniversary of Dr. Verghese Kurien. Known as the architect of Operation Flood, Dr. Kurien spearheaded the cooperative dairying movement that empowered rural farmers, transformed Indian agriculture, and established India as the global leader in milk production.

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CHAPTER 31

Poultry, Fisheries, Beekeeping and Sericulture

1. Which of the following is considered the best and most widely used poultry breed for commercial egg production in India?
(A) Rhode Island Red
(B) White Leghorn
(C) Plymouth Rock
(D) Aseel

2. At what age are commercial broiler chickens typically harvested for market weight under standard management practices?
(A) 3 to 4 weeks
(B) 6 to 8 weeks
(C) 12 to 14 weeks
(D) 18 to 20 weeks

3. Consider the following statements regarding the management of layer poultry:
I. Layers require 14 to 16 hours of daily light to stimulate maximum egg production.
II. Supplemental calcium is essential in the layer diet to ensure proper eggshell formation.
III. Culling of unproductive birds should be strictly avoided to maintain flock density.
Which of the above statements is/are correct?
(A) I and II only
(B) II and III only
(C) I and III only
(D) I, II and III

4. In poultry farming terminology, what does the abbreviation FCR stand for?
(A) Fowl Cholera Resistance
(B) Flock Culling Rate
(C) Feed Conversion Ratio
(D) Fattening Capacity Ratio

5. Which of the following indigenous poultry breeds is most famous for its use in cockfighting and has excellent meat quality?
(A) Aseel
(B) Kadaknath
(C) Chittagong
(D) Busra

6. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): Artificial lighting is provided in layer poultry houses during the night.
Reason (R): Light stimulates the pituitary gland, which helps in the release of hormones necessary for egg production.
(A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
(B) Both Assertion (A) and Reason (R) are true but R is not the correct explanation of A.
(C) Assertion (A) is true but Reason (R) is false.
(D) Assertion (A) is false but Reason (R) is true.

7. Which of the following is NOT a viral disease affecting poultry?
(A) Ranikhet disease (Newcastle disease)
(B) Coccidiosis
(C) Marek's disease
(D) Fowl pox

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8. The first vaccination generally given to day-old chicks at the hatchery is to protect against which disease?
(A) Fowl cholera
(B) Infectious Coryza
(C) Marek's disease
(D) Salmonellosis

9. What is the standard recommended floor space per broiler bird under the deep litter system of rearing?
(A) 0.5 square feet
(B) 1.0 square feet
(C) 2.5 square feet
(D) 3.0 square feet

10. Given below are two lists, List I (Poultry Disease) and List II (Causal Organism). Match List I with List II:
List I: (Poultry Disease)
P. Ranikhet disease
Q. Fowl cholera

71. In sericulture, "Chawki rearing" specifically refers to the scientific management of:
(A) Harvested silk cocoons during the commercial stifling process
(B) Young silkworms up to second instar
(C) Fully mature silkworms during the active cocoon spinning stage
(D) Emerging adult moths during the controlled mating and egg-laying process

72. 'Denier' is a standard unit of measurement used in the sericulture industry to express the:
(A) Total weight of the mulberry leaves consumed
(B) Hatching percentage of silkworm eggs
(C) Thickness or fineness of the silk yarn
(D) Tensile strength of the cocoon shell

73. Which of the following is a major and destructive parasitoid pest of the silkworm during its rearing phase?
(A) Whitefly
(B) Pyrilla
(C) Top borer
(D) Uzi fly

74. Which type of silk constitutes the largest share of total raw silk production in India?
(A) Mulberry silk
(B) Tasar silk
(C) Eri silk
(D) Muga silk

75. Which of the following best describes the main economic advantage of adopting an Integrated Farming System (IFS) for a smallholder farmer?
(A) It completely eliminates the need for any manual operational labor on the farm.
(B) Waste recycling between enterprises to reduce costs and risk.
(C) It strictly forces the farmer to specialize in growing only one highly profitable cash crop.
(D) It ensures that agricultural crops no longer require any external water for irrigation.

76. Which of the following government schemes is NOT directly associated with the development of poultry, fisheries, beekeeping, or sericulture?
(A) Pradhan Mantri Matsya Sampada Yojana (PMMSY)
(B) Pradhan Mantri Krishi Sinchayee Yojana (PMKSY)
(C) National Beekeeping & Honey Mission (NBHM)
(D) Silk Samagra

77. The Central Sericultural Research and Training Institute (CSRTI), a premier institute for research in mulberry sericulture under the Central Silk Board, is located at:
(A) Mysuru (Mysore)
(B) Dehradun (Uttarakhand)
(C) Lucknow (Uttar Pradesh)
(D) Ranchi (Jharkhand)

78. In the silkworm rearing process, what is the specific function of a "Mountage" (also known as Chandrike)?
(A) It is the specialized tray where silkworm eggs are incubated before hatching.
(B) It is the motorized mechanical device used to reel silk threads from cocoons.
(C) A structure for mature larvae to spin cocoons.
(D) It is a protective mesh net used to trap parasitic uzi flies in rearing rooms.

79. The commercial process of unwinding the continuous silk filament from stifled and cooked cocoons is known as:
(A) Degumming
(B) Throwing
(C) Spun silk processing
(D) Reeling

80. In an integrated duck-fish farming model, what is the primary benefit that the ducks provide to the pond ecosystem?
(A) They actively hunt and consume large predatory fish to protect growing carp fingerlings.
(B) They selectively consume excess phytoplankton, preventing oxygen depletion during the day.
(C) They aerate water by swimming and fertilize with droppings.
(D) They shade the pond surface completely, significantly reducing water temperature in summer.

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(D) To increase the overall water depth and volume of the pond

20. Given below are two lists, List I (Carp Species) and List II (Feeding Zone). Match List I with List II:
List I: (Carp Species)
P. Catla
Q. Rohu
R. Mrigal
S. Grass Carp
List II: (Feeding Zone)
1. Bottom feeder
2. Macrophyte (aquatic weed) feeder
3. Column feeder
4. Surface feeder
Select the correct matching code:
(A) P-4, Q-3, R-1, S-2
(B) P-4, Q-1, R-3, S-2
(C) P-3, Q-4, R-1, S-2
(D) P-1, Q-3, R-4, S-2

21. Which of the following is the scientific name of the Indian honey bee, commonly reared in traditional beekeeping?
(A) Apis cerana indica
(B) Apis mellifera
(C) Apis dorsata
(D) Apis florea

22. Which bee species was introduced to India for its high honey yielding capacity and calm temperament, revolutionizing commercial beekeeping?
(A) Apis cerana indica
(B) Apis dorsata
(C) Tetragonula iridipennis
(D) Apis mellifera

23. Consider the following statements regarding the castes in a honey bee colony:
I. The queen bee is a fertile female responsible for laying eggs.
II. Worker bees are fertile females that forage for nectar and pollen.
III. Drones are male bees whose primary function is to mate with a virgin queen.
Which of the above statements is/are correct?
(A) I and II only
(B) I and III only
(C) II and III only
(D) I, II and III

24. In beekeeping terminology, the complete desertion of the hive by the entire bee colony due to unfavourable conditions or pests is known as:
(A) Swarming
(B) Supering
(C) Absconding
(D) Foraging

25. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): Keeping bee boxes in mustard or sunflower fields significantly increases the crop yield.
Reason (R): Honey bees act as highly efficient pollinators, facilitating cross-pollination while collecting nectar and pollen.
(A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
(B) Both Assertion (A) and Reason (R) are true but R is not the correct explanation of A.
(C) Assertion (A) is true but Reason (R) is false.
(D) Assertion (A) is false but Reason (R) is true.

26. Which specific glandular secretion of nurse bees is fed exclusively to the queen bee throughout her larval and adult life?
(A) Royal jelly
(B) Bee bread
(C) Propolis
(D) Beeswax

27. High-quality ripe honey, processed correctly by the bees, typically has a moisture content of:
(A) Less than 20%
(B) 25% to 30%
(C) 35% to 40%
(D) More than 50%

28. What is the main function of a 'Smoker' in apiary management?
(A) To effectively fumigate the hive against parasitic varroa mites
(B) To pacify the bees for safe hive inspection
(C) To extract pure honey from the combs without breaking the wax structure
(D) To melt harvested beeswax for making standard comb foundation sheets

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29. Select the correct standard sequence for extracting honey from a hive:
(A) Uncapping of combs → Centrifugal extracting → Straining → Bottling
(B) Centrifugal extracting → Uncapping of

(A) The shell constitutes approximately 30% of the total structural egg weight.
(B) The yolk is composed mostly of pure carbohydrates and simple sugars.
(C) The air cell is normally located at the small, narrow end of the egg shell.
(D) The albumen forms 58-60% of the egg weight.

51. The Pradhan Mantri Matsya Sampada Yojana (PMMSY) is a flagship scheme launched by the Government of India primarily aimed at:
(A) Sustainable development of the fisheries sector
(B) Free distribution of synthetic fishing nets to all registered marine fishermen
(C) Strict banning of inland commercial aquaculture practices to conserve fresh water
(D) Complete replacement of native carp species with exotic predatory fishes in ponds

52. Consider the following water quality parameters for fish pond management:
I. Turbidity caused by excessive plankton bloom can lead to oxygen depletion at night.
II. Ammonia levels in the pond water should ideally be kept below 0.1 ppm.
III. High alkalinity is detrimental and completely stunts the growth of zooplankton.
IV. Water temperature regulates the metabolic rate of the fish.
Which combination of statements is correct?
(A) I, II and III
(B) I, II and IV
(C) II, III and IV
(D) I, III and IV

53. In aquaculture terminology, a "fingerling" typically refers to fish seed that has attained a length of approximately:
(A) 1 to 2 cm
(B) 3 to 5 cm
(C) 10 to 15 cm
(D) 25 to 30 cm

54. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): In integrated poultry-fish farming, chemical fertilizers are generally not required for the fish pond.
Reason (R): Fresh poultry droppings falling directly into the pond act as an excellent complete fertilizer, promoting rapid growth of natural fish food.
(A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
(B) Both Assertion (A) and Reason (R) are true but R is not the correct explanation of A.
(C) Assertion (A) is true but Reason (R) is false.
(D) Assertion (A) is false but Reason (R) is true.

55. Which of the following statements about induced breeding in inland fisheries is INCORRECT?
(A) It is primarily conducted to ensure the timely availability of high-quality pure fish seed.
(B) It prohibits spawning of Major Carps in hatcheries.
(C) Pituitary gland extract is traditionally and successfully used as an effective inducing agent.
(D) Synthetic hormone formulations like Ovaprim are now extensively used for fish injection.

56. Which of the following fishes is categorized as an air-breathing fish and is highly suitable for culture in shallow, derelict, or swampy water bodies?
(A) Labeo rohita (Rohu)
(B) Cyprinus carpio (Common carp)
(C) Clarias batrachus (Magur)
(D) Ctenopharyngodon idella (Grass carp)

57. A 'Secchi disc' is a standard instrument used in aquaculture management to measure:
(A) Dissolved oxygen concentration levels
(B) Total dissolved solid particles in water
(C) Ambient surface water temperature
(D) Water transparency

58. Which is considered the most significant biological constraint in traditional rural fish farming in village ponds?
(A) Unmanaged predatory and weed fishes
(B) Maintaining excessively high depth of water throughout the entire culture year
(C) Continuous over-abundance of dissolved oxygen levels in the pond water
(D) Extremely low overall surface area of the rural culture pond

59. What is the commonly recommended stocking ratio of Catla, Rohu, and Mrigal in a 3-species Indian Major Carp polyculture system?
(A) 10 : 80 : 10
(B) 40 : 30 : 30

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39. Raw silk fiber is naturally composed of two main proteins. These are:
(A) Keratin and Collagen
(B) Fibroin and Sericin
(C) Casein and Albumin
(D) Actin and Myosin

40. The Central Sector Scheme launched by the Government of India for the holistic development of the sericulture industry is known as:
(A) Resham Vikas Yojana
(B) PM Matsya Sampada Yojana
(C) Silk Samagra
(D) Krishi Udan

41. In commercial poultry farming, a grower mash feed typically contains approximately what percentage of crude protein?
(A) 10-12%
(B) 15-16%
(C) 22-24%
(D) 28-30%

42. Which of the following is NOT an objective of an Integrated Farming System (IFS)?
(A) Maximizing dependence on external chemical inputs
(B) Efficient recycling of farm waste
(C) Increasing continuous employment generation
(D) Minimizing economic risk by diversifying income sources

43. Consider the following statements about Poultry-Fish integrated farming:
I. Poultry droppings act as an excellent organic fertilizer for the fish pond.
II. This system reduces the cost of supplementary fish feed.
III. It requires continuous application of heavy doses of synthetic fertilizers to maintain the pond ecosystem.
Which of the above statements is/are correct?
(A) I and II only
(B) II and III only
(C) I and III only
(D) I, II and III

44. In waterlogged lowland paddy fields, which allied enterprise is most complementary and frequently integrated with rice cultivation?
(A) Dairy farming
(B) Fish farming
(C) Sericulture
(D) Beekeeping

45. The 'LaSota' strain vaccine is widely administered to poultry flocks for prevention against:
(A) Ranikhet disease
(B) Marek's disease in young poultry
(C) Fowl pox infection in layer birds
(D) Infectious bronchitis virus in flocks

46. Given below are two lists, List I (Poultry Practice) and List II (Primary Purpose). Match List I with List II:
List I: (Poultry Practice)
P. Debeaking
Q. Candling
R. Culling
S. Brooding
List II: (Primary Purpose)
1. Removing unproductive birds
2. Providing artificial heat to day-old chicks
3. Checking fertility and internal defects of eggs
4. Preventing cannibalism and feather pecking
Select the correct matching code:
(A) P-4, Q-3, R-1, S-2
(B) P-3, Q-4, R-1, S-2
(C) P-4, Q-1, R-3, S-2
(D) P-1, Q-3, R-4, S-2

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47. Which of the following is a heavy, meat-type exotic poultry breed heavily utilized in the development of modern commercial broilers?
(A) White Leghorn
(B) Minorca
(C) Australorp
(D) White Cornish

48. Identify the odd one out from the following list of poultry breeds:
(A) Kadaknath
(B) Rhode Island Red
(C) Khaki Campbell
(D) Aseel

49. In the deep litter system of poultry management, the starting thickness of the bedding material (litter) is usually maintained around:
(A) 1 to 2 inches
(B) 3 to 5 inches
(C) 10 to 12 inches
(D) 15 to 20 inches

50. Which of the following is a correct statement regarding the physical composition of a standard chicken egg?

R. Coccidiosis
S. Aspergillosis
List II: (Causal Organism)
1. Bacteria
2. Virus
3. Fungus
4. Protozoa
Select the correct matching code:
(A) P-2, Q-1, R-4, S-3
(B) P-1, Q-2, R-3, S-4
(C) P-2, Q-4, R-1, S-3
(D) P-4, Q-1, R-2, S-3

11. Which of the following fish species belongs to the group of Indian Major Carps (IMC)?
(A) Common carp
(B) Rohu
(C) Silver carp
(D) Grass carp

12. Arrange the following standard steps of pre-stocking management in a new fish pond in the correct chronological order:
1. Liming
2. Pond drying and cleaning
3. Stocking of fish seed
4. Application of organic manure and fertilizers
Select the correct order from the options given below:
(A) 1 - 2 - 4 - 3
(B) 2 - 1 - 4 - 3
(C) 2 - 4 - 1 - 3
(D) 4 - 2 - 1 - 3

13. What is the ideal pH range of pond water for optimum growth of fish in commercial aquaculture?
(A) 4.5 to 5.5
(B) 6.0 to 6.5
(C) 7.5 to 8.5
(D) 9.5 to 10.5

14. Consider the following statements regarding composite fish culture:
I. It involves rearing of multiple compatible fish species in the same pond.
II. It ensures complete utilization of natural food available in different water zones.
III. Catla is primarily stocked to utilize the bottom zone of the pond.
IV. High yields can be achieved as competition for food is minimized among the species.
Which combination of statements is correct?
(A) I, II and III
(B) I, II and IV
(C) II, III and IV
(D) I, III and IV

15. In a composite fish culture system, which of the following fishes acts as a bottom feeder?
(A) Catla
(B) Rohu
(C) Silver carp
(D) Mrigal

16. The comprehensive government initiative launched to enhance fish production and modernize the fisheries sector in India is known as the:
(A) White Revolution
(B) Yellow Revolution
(C) Blue Revolution
(D) Golden Revolution

17. Consider the following options regarding water quality parameters. Which of the following is an INCORRECT statement regarding Dissolved Oxygen (DO) in a fish pond?
(A) Photosynthesis by phytoplankton actively adds dissolved oxygen to the water during the day.
(B) Fish ponds require a minimum DO level of 1.0 ppm for optimal growth.
(C) Dissolved oxygen levels generally fall to their lowest point in early morning before sunrise.
(D) Mechanical aerators can be routinely used to increase dissolved oxygen in intensive culture.

18. Select the correct order of energy flow (food chain) in a typical fish pond ecosystem:
(A) Zooplankton → Phytoplankton → Small fish → Large fish
(B) Phytoplankton → Zooplankton → Small fish → Large fish
(C) Small fish → Zooplankton → Phytoplankton → Large fish
(D) Phytoplankton → Small fish → Zooplankton → Large fish

19. What is the primary purpose of applying lime (calcium carbonate/quicklime) during fish pond preparation?
(A) To correct soil and water acidity
(B) To significantly increase the natural protein content of the water
(C) To act as a direct supplementary feed for bottom-feeding fish

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(C) 70 : 15 : 15
(D) 20 : 20 : 60

60. Consider the following statements regarding the expected benefits of the Blue Revolution in India:
I. It aims to double the income of fishers and fish farmers.
II. It focuses on encouraging complete shift from agriculture to marine capture fisheries.
III. It promotes entrepreneurship and modernization of the aquaculture value chain.
Which of the above statements is/are correct?
(A) I and II only
(B) I and III only
(C) II and III only
(D) I, II and III

61. The concept of "Bee Space," which revolutionized modern commercial beekeeping by preventing bees from sealing frames together, was discovered by:
(A) L.L. Langstroth
(B) Karl von Frisch
(C) Gregor Mendel
(D) Charles Darwin

62. In a honey bee colony, which caste develops strictly from unfertilized eggs through the process of parthenogenesis?
(A) Queen
(B) Worker
(C) Drone
(D) Both Worker and Queen

63. The 'Wagtail dance' performed by foraging worker bees is a communication mechanism used primarily to indicate:
(A) The exact solar time of the day for foraging activity
(B) The immediate presence of a dangerous predatory wasp near the hive entrance
(C) The urgent physical need for the colony to begin swarming immediately
(D) Food source distance and direction

64. Identify the odd one out among the following honey bee species based on their origin:
(A) Apis dorsata
(B) Apis florea
(C) Apis mellifera
(D) Apis cerana

65. Which of the following is NOT an equipment or tool used in a standard apiary?
(A) Queen excluder
(B) Secchi disc
(C) Honey extractor
(D) Uncapping knife

66. Identify the CORRECT pair of bee disease and its causative agent:
(A) American Foulbrood - Virus
(B) Sacbrood - Fungus
(C) Chalkbrood - Bacteria
(D) Nosema - Protozoa

67. The term "Sweet Revolution", strongly promoted by the Government of India, is associated with the promotion and development of:
(A) Beekeeping and honey
(B) Commercial sugarcane cultivation and processing
(C) Large-scale sugarbeet farming and extraction
(D) Organic stevia plant cultivation and herbal processing

68. Propolis, a resinous mixture collected by honey bees, is primarily used by the colony to:
(A) Feed and nourish the newly hatched young worker larvae
(B) Dilute highly concentrated flower nectar collected by foragers
(C) Seal cracks and hive openings
(D) Construct the primary hexagonal brood cells of the comb structure

69. A standard Langstroth beehive brood chamber typically accommodates how many wooden frames?
(A) 4 or 5
(B) 10
(C) 20
(D) 25

70. What is the primary operational advantage of practicing migratory beekeeping for a rural entrepreneur?
(A) It significantly reduces the overall physical labor required for extraction.
(B) It completely eliminates the possibility of bacterial and viral bee diseases.
(C) It effectively prevents the breeding queen bee from aging naturally.
(D) Continuous floral pasturage to maximize honey yield.

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combs → Bottling → Straining
(C) Straining → Uncapping of combs → Centrifugal extracting → Bottling
(D) Bottling → Straining → Uncapping of combs → Centrifugal extracting

30. Which nodal agency under the Ministry of Agriculture and Farmers Welfare implements the National Beekeeping & Honey Mission (NBHM)?
(A) National Dairy Development Board (NDDB)
(B) Khadi and Village Industries Commission (KVIC)
(C) National Bee Board (NBB)
(D) Indian Council of Agricultural Research (ICAR)

31. The most widely cultivated silkworm species globally, which feeds exclusively on mulberry leaves, is:
(A) Antheraea mylitta
(B) Samia ricini
(C) Antheraea assamensis
(D) Bombyx mori

32. Given below are two lists, List I (Type of Silk) and List II (Primary Host Plant). Match List I with List II:
List I: (Type of Silk)
P. Mulberry Silk
Q. Tasar Silk
R. Eri Silk
S. Muga Silk
List II: (Primary Host Plant)
1. Castor
2. Morus alba
3. Som and Soalu
4. Arjun and Asan
Select the correct matching code:
(A) P-2, Q-4, R-1, S-3
(B) P-2, Q-1, R-4, S-3
(C) P-4, Q-2, R-1, S-3
(D) P-3, Q-4, R-1, S-2

33. The agricultural practice of cultivating mulberry plants specifically for rearing silkworms is called:
(A) Silviculture
(B) Moriculture
(C) Arboriculture
(D) Olericulture

34. Which highly valued golden-yellow silk is exclusively produced in the Brahmaputra valley of Assam, India?
(A) Tasar silk
(B) Eri silk
(C) Mulberry silk
(D) Muga silk

35. Consider the following statements regarding the sericulture process:
I. Brushing is the process of transferring newly hatched silkworm larvae to rearing trays.
II. Chawki rearing refers to the care of early instar (1st and 2nd stage) silkworms.
III. Silkworms stop feeding during the moulting stages.
IV. The spinning of the cocoon is done by the adult moth.
Which combination of statements is correct?
(A) I, II and IV
(B) II, III and IV
(C) I, II and III
(D) I, III and IV

36. Which of the following is an INCORRECT pairing of a silkworm disease and its causal agent?
(A) Pebrine disease - Protozoa
(B) Flacherie disease - Bacteria
(C) Muscardine - Nematode
(D) Grasserie disease - Virus

37. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): Microscopic examination of mother moths is a mandatory practice in silkworm seed production centers.
Reason (R): Pebrine is a deadly protozoan disease that is transmitted transovarially from the mother moth to the offspring.
(A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
(B) Both Assertion (A) and Reason (R) are true but R is not the correct explanation of A.
(C) Assertion (A) is true but Reason (R) is false.
(D) Assertion (A) is false but Reason (R) is true.

38. The process of killing the pupa inside the silkworm cocoon before it emerges as a moth, in order to keep the continuous silk thread intact, is called:
(A) Reeling
(B) Degumming
(C) Throwing
(D) Stifling

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ANSWERS

1. (B) White Leghorn
White Leghorn is widely acknowledged as the premier commercial layer breed across India and globally due to its exceptional egg-laying efficiency. This breed produces a high yield of large white-shelled eggs while maintaining minimal body weight, which significantly reduces feed maintenance costs. Consequently, it dominates commercial poultry egg production operations nationwide and worldwide.

2. (B) 6 to 8 weeks
Commercial broiler chickens are genetically selected for exceptionally rapid growth and high feed efficiency, reaching market weight in roughly six to eight weeks. Beyond this period, their growth rate decreases relative to feed consumption, leading to reduced economic efficiency and increased risk of metabolic and skeletal issues under standard farming management.

3. (A) I and II only
Providing 14 to 16 hours of daily light stimulates the pituitary gland to release reproductive hormones essential for laying eggs, whereas extra calcium is critical for proper eggshell formation. Unproductive layers must be regularly culled rather than kept, as culling reduces feed costs and prevents unnecessary overcrowd pressure in poultry operations.

4. (C) Feed Conversion Ratio
Feed Conversion Ratio measures the efficiency with which livestock converts feed intake into output, such as live body weight or eggs. In poultry production, a lower ratio indicates superior conversion efficiency, meaning less feed is needed to produce a unit weight of meat, directly lowering operational production costs for poultry farmers.

5. (A) Aseel
Aseel is an indigenous Indian poultry breed renowned for its aggressive nature, stamina, and physical strength, making it historically famous for cockfighting. Apart from its pugnacity, the breed is valued for its high-quality, flavorful meat with dense muscular tissue, making it a highly sought-after indigenous breed among backyard poultry farmers everywhere.

6. (A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
Artificial lighting extended into the night stimulates the anterior pituitary gland via the optic nerve, triggering the secretion of luteinizing hormone and follicle-stimulating hormone. These hormones regulate ovulation and yolk release, maintaining high egg production levels. Thus, night illumination directly drives the physiological mechanism responsible for continuous commercial layer productivity in farms.

7. (B) Coccidiosis
Coccidiosis is a parasitic protozoan disease caused by microscopic intestinal parasites belonging to the genus Eimeria. It damages the intestinal lining of poultry, leading to bloody diarrhoea, poor nutrient absorption, and weight loss. In contrast, Newcastle disease, Marek's disease, and fowl pox are all pathogenic viral infections affecting domestic avian birds.

8. (C) Marek's disease
Vaccination against Marek's disease is routinely administered to day-old chicks at commercial hatcheries, either subcutaneously or in ovo, before distribution. Marek's disease is a highly contagious herpesvirus infection that causes T-cell lymphomas and peripheral nerve enlargement, leading to paralysis and high mortality if young chicks remain unvaccinated during early brooding phases.

9. (B) 1.0 square feet
Under the deep litter rearing system, the recommended floor space allocation for market broilers is approximately 1.0 square foot per bird. Providing adequate floor space prevents overcrowding, reduces litter moisture accumulation, decreases disease transmission, and lowers mortality, thereby ensuring optimum growth performance and welfare throughout the entire broiler rearing cycle.

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10. (A) P-2, Q-1, R-4, S-3
Ranikhet disease is a severe viral infection caused by paramyxovirus, whereas Fowl Cholera is a bacterial disease caused by Pasteurella multocida. Coccidiosis is an intestinal condition triggered by protozoan parasites of Eimeria, and Aspergillosis is a pulmonary fungal infection caused by Aspergillus species contaminating the poultry litter environment frequently.

11. (B) Rohu
Rohu, scientifically named Labeo rohita, is one of the primary indigenous freshwater carp species belonging to the Indian Major Carps group alongside Catla and Mrigal. In contrast, Common carp, Silver carp, and Grass carp are categorized as Exotic Carps, which were introduced to India for freshwater aquaculture diversification nationwide.

12. (B) 2 - 1 - 4 - 3
Proper pond preparation begins with drying and cleaning to eradicate pathogens and wild predators. Liming is performed next to neutralize soil acidity and disinfect the pond bottom. Organic manuring and fertilizing follow to promote dense plankton production, and once natural food is established, stocking of fish seed is safely carried out.

13. (C) 7.5 to 8.5
A slightly alkaline pH range of 7.5 to 8.5 is optimal for fish health and growth in commercial aquaculture ponds. Water within this range promotes physiological biological processes, enhances primary biological productivity, ensures efficient nutrient availability, and supports a rich population of plankton while preventing toxic acid or alkali stress.

14. (B) I, II and IV
Composite fish culture utilizes compatible fish species occupying distinct ecological niches, maximizing natural food usage across surface, column, and bottom pond layers. Catla is a fast-growing surface feeder rather than a bottom feeder. By selecting species with non-overlapping feeding habits, competition for food is minimized, resulting in high production yields.

15. (D) Mrigal
Mrigal, scientifically known as Cirrhinus mrigala, functions as a bottom feeder in polyculture and composite fish systems. It feeds mainly on benthic detritus, decaying organic matter, and microscopic organisms present on the pond floor. This niche division prevents competition with surface feeders like Catla and column feeders like Rohu effectively.

16. (C) Blue Revolution
The Blue Revolution refers to the strategic government framework implemented to rapidly expand, modernize, and sustainably manage the aquaculture and fisheries sectors. It focuses on enhancing fish production, improving infrastructure, boosting export earnings, and strengthening economic security for fishermen, distinct from the White Revolution for milk and Yellow Revolution for oilseeds.

17. (B) Fish ponds require a minimum DO level of 1.0 ppm for optimal growth.
Dissolved oxygen levels of 1.0 ppm are critically low and cause severe hypoxia, stress, reduced feeding, and mass mortality in cultured fish. Optimal fish growth and health require a minimum dissolved oxygen level of 5.0 ppm. Photosynthesis increases oxygen daytime levels, while night respiratory demands lower oxygen to its minimum before dawn.

18. (B) Phytoplankton → Zooplankton → Small fish → Large fish
Energy flow in a pond ecosystem begins with primary producers, specifically photosynthetic phytoplankton. Herbivorous zooplankton consume phytoplankton as primary consumers. Small fish then feed on zooplankton as secondary consumers, and larger predatory fish occupy higher trophic levels by preying on smaller fish, establishing a clear sequential aquatic food chain flow.

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19. (A) To correct soil and water acidity
Application of lime during pond preparation neutralizes acidic soil and water, raising the pH to a favorable alkaline level. Liming also acts as a pond disinfectant, enhances phosphate availability, promotes organic decomposition, improves water buffering capacity, and stabilizes environmental conditions necessary for maintaining a healthy plankton population and fish ecosystem.

20. (A) P-4, Q-3, R-1, S-2
In polyculture, Catla feeds on plankton at the surface zone, while Rohu occupies the middle

column zone. Mrigal feeds on organic detritus at the pond bottom, and Grass Carp specifically consumes aquatic weeds and macrovegetation. Matching these species according to their natural feeding zones ensures efficient utilization of pond resources.

21. (A) Apis cerana indica
Apis cerana indica is the scientific name of the Indian hive bee, a domesticated honey bee subspecies native to southern Asia. It is widely managed in traditional and modern movable frame hives throughout India. This species is known for its adaptable nature, steady honey production, and docility compared to wild species.

22. (D) Apis mellifera
Apis mellifera, commonly known as the European or Western honey bee, was introduced to India to enhance commercial honey production. It exhibits a calm temperament, high foraging efficiency, low swarming tendency, and significantly higher honey yields per colony compared to indigenous species, leading to its widespread adoption in modern apiaries.

23. (B) I and III only
In a honey bee colony, the queen is the fertile female responsible for reproduction, while drones are fertile males whose function is mating with virgin queens. Worker bees are sterile females performing all hive maintenance, brood nursing, and foraging, making the statement describing worker bees as fertile female foragers biologically incorrect.

24. (C) Absconding
Absconding refers to the complete abandonment of a hive by an entire honey bee colony, including the queen and workers. This behavior occurs in response to severe adverse conditions such as acute food scarcity, persistent pest infestations like wax moths, continuous disturbance, or unsuitable environmental temperatures, unlike reproductive swarming behavior.

25. (A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
Placing beehives in flowering crop fields like mustard or sunflower significantly enhances crop seed and fruit yields. Honey bees are highly active pollinators that transfer pollen grains between flowers while collecting nectar and pollen. This cross-pollination increases fertilization rates and seed set, directly explaining the observed crop yield enhancement effectively.

26. (A) Royal jelly
Royal jelly is a protein-rich secretion produced by the hypopharyngeal and mandibular glands of young worker nurse bees. While all bee larvae feed on royal jelly for their first few days, larvae selected to become queens and adult queen bees are fed royal jelly exclusively, triggering complete anatomical and functional sexual development.

27. (A) Less than 20%
Fully ripened honey processed by honey bees typically contains less than 20% moisture, usually around 17% to 18%. Bees reduce moisture through fanning activity and seal filled comb cells with wax caps. Maintaining moisture below 20% prevents osmotic yeast fermentation, ensuring shelf stability, safety, and high commercial market quality standards.

28. (B) To pacify the bees for safe hive inspection
A smoker generates cool smoke from burning organic materials, which is puffed into hive entrances during management operations. The smoke masks alarm pheromones released by guard bees and prompts bees to consume stored honey, making them submissive and calm, which allows beekeepers to inspect hives and harvest honey safely always.

29. (A) Uncapping of combs → Centrifugal extracting → Straining → Bottling
Processing honey follows a sequential workflow beginning with removing wax caps from sealed honeycombs using an uncapping knife. Uncapped frames are spun in a centrifugal honey extractor to discharge liquid honey without damaging wax combs. The extracted liquid is strained to remove wax particles and impurities before final hygienic bottling.

30. (C) National Bee Board (NBB)
The National Bee Board functions as the executive nodal agency responsible for implementing the National Beekeeping & Honey Mission under the Ministry of Agriculture and Farmers Welfare. It coordinates capacity building, scientific apiculture practices, infrastructure establishment, quality testing laboratories, and promotional strategies across India to advance the Sweet Revolution nationwide.

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a 9,000-meter continuous strand of yarn. Lower denier values indicate finer, delicate threads, whereas higher values denote thicker strands.

73. (D) Uzi fly
The Uzi fly, Exorista bombycis, is a major endoparasitoid pest affecting mulberry silkworms. Female Uzi flies lay eggs directly on silkworm larvae. Upon hatching, Uzi fly maggots burrow into the silkworm body tissue, feeding on internal organs and killing the host before or during cocoon formation, causing substantial economic losses.

74. (A) Mulberry silk
Mulberry silk accounts for over 70% of total raw silk output in India, making it the dominant variety in domestic silk production. Extracted from Bombyx mori cocoons, mulberry silk is highly valued for its superior luster, high tensile strength, smooth texture, and uniform fineness compared to wild silk varieties like Tasar, Eri, and Muga.

75. (B) Waste recycling between enterprises to reduce costs and risk.
Integrated Farming Systems integrate multiple complementary farm activities like crops, livestock, poultry, and aquaculture. By recycling waste products from one sub-system as inputs for another, smallholder farmers significantly lower feed and fertilizer production expenses, optimize resource utilization efficiency, enhance total net income, and lower market or climate failure risks effectively.

76. (B) Pradhan Mantri Krishi Sinchayee Yojana (PMKSY)
Pradhan Mantri Krishi Sinchayee Yojana is a national scheme focused on expanding water irrigation coverage, enhancing water use efficiency on crop fields, and micro-irrigation infrastructure. Unlike PMMSY for fisheries, NBHM for apiculture, or Silk Samagra for sericulture, PMKSY focuses on agricultural irrigation rather than allied livestock or agro-based enterprises directly.

77. (A) Mysuru (Mysore)
The Central Sericultural Research and Training Institute in Mysuru, Karnataka, is the premier research institution established under the Central Silk Board. Founded in 1961, CSRTI Mysuru conducts advanced research in mulberry breeding, agronomy, host plant protection, silkworm genetic improvement, and extension activities to support mulberry silk production across South India.

78. (C) A structure for mature larvae to spin cocoons.
A Mountage, locally called Chandrike, is a specialized wooden or bamboo frame structure provided to mature fifth-instar silkworms during the spinning phase. When larvae stop feeding and prepare to spin silk, they are transferred onto mountages, which provide separate, stable anchorage compartments for silkworms to construct uniform, undamaged silk cocoons.

79. (D) Reeling
Silk reeling is the commercial post-harvest process of unwinding long, continuous silk filaments from cooked, stifled silkworm cocoons. Stifled cocoons are softened in hot water baths to dissolve outer sericin gum, allowing end filaments from several cocoons to be gathered and reeled together onto motorized spools as smooth raw silk yarn.

80. (C) They aerate water by swimming and fertilize with droppings.
In integrated duck-fish farming, ducks paddle across the pond surface, stirring water layer columns and aerating the surface to enhance dissolved oxygen levels. Simultaneously, duck droppings fall into the water, serving as a rich organic fertilizer that stimulates biological plankton growth while duck activity helps control surface weeds and insects.

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This protein level supports balanced skeletal, muscular, and organ development without causing premature sexual maturity, preparing young birds for optimal productivity before transitioning to high-protein layer feeds later.

42. (A) Maximizing dependence on external chemical inputs
Integrated Farming Systems aim to create sustainable agricultural ecosystems through resource recycling, enterprise diversification, and waste utilization, thereby reducing reliance on costly synthetic chemical fertilizers and pesticides. Maximizing dependence on external chemical inputs contradicts the foundational principles of economic sustainability and environmental conservation underlying integrated farming practices completely.

43. (A) I and II only
In integrated poultry-fish culture, nutrient-rich poultry manure serves as an effective organic pond fertilizer, stimulating plankton growth and reducing supplementary fish feeding costs. Heavy application of synthetic chemical fertilizers is unnecessary and detrimental, as excess chemical inputs pollute water quality, induce plankton blooms, and elevate toxic ammonia levels rapidly.

44. (B) Fish farming
Rice-fish integration is highly complementary in low-lying, waterlogged paddy ecosystems. Flooded rice fields provide natural shade, shelter, and aquatic organisms that serve as food for fish. Concurrently, fish control weeds and insect pests, aerate the soil through movement, and fertilize crops with excreted waste, boosting total farm yield efficiency.

45. (A) Ranikhet disease
The LaSota live virus strain vaccine is globally utilized to immunize poultry against Ranikhet disease, also known as Newcastle disease. Administered via drinking water, eye drops, or spray, LaSota provides robust mucosal and systemic immunity against virulent Newcastle disease virus strains, protecting flocks from severe respiratory and neurological losses effectively.

46. (A) P-4, Q-3, R-1, S-2
Debeaking trims beak tips to prevent cannibalism, while candling uses light to inspect egg fertility and defects. Culling removes unproductive birds to optimize feed conversion, and brooding provides artificial heat to day-old chicks until thermo-regulation develops. Each practice addresses a specific management requirement in commercial poultry production operations successfully.

47. (D) White Cornish
White Cornish is a heavy, English-origin poultry breed possessing broad breast muscle mass, sturdy skeletal structure, and fast growth rates. Due to these meat production traits, White Cornish male lines are extensively crossed with White Plymouth Rock female lines to produce modern commercial broiler hybrids raised for meat globally today.

48. (C) Khaki Campbell
Khaki Campbell is a high-yielding duck breed reared for egg laying, whereas Kadaknath, Rhode Island Red, and Aseel are distinct chicken breeds. Kadaknath and Aseel represent indigenous Indian chicken breeds, and Rhode Island Red is an exotic dual-purpose chicken breed, making Khaki Campbell the distinct waterfowl species in the list.

49. (B) 3 to 5 inches
In deep litter poultry housing, the initial depth of absorbent litter material such as paddy husk, sawdust, or wood shavings is maintained at 3 to 5 inches. This thickness absorbs moisture from bird droppings, facilitates bacterial decomposition, provides physical insulation against cold floors, and promotes comfortable bedding for birds always.

50. (D) The albumen forms 58-60% of the egg weight.
In a standard chicken egg, egg white or albumen comprises approximately 58% to 60% of total structural egg weight, consisting mainly of water and proteins. Yolk accounts for roughly 30% and contains lipids and proteins, whereas the calcified outer shell makes up about 10% to 12% of total egg weight.

51. (A) Sustainable development of the fisheries sector
The Pradhan Mantri Matsya Sampada Yojana is a scheme aimed at bringing about the Blue Revolution through sustainable development of India's fisheries sector. It targets boosting fish production, modernizing supply chains, improving post-harvest management, generating rural employment, and enhancing socio-economic

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10. Which intermediate host is crucial for the completion of the life cycle of the liver fluke (Fasciola hepatica) causing parasitic disease in livestock?
(A) Snail
(B) Mosquito
(C) Sandfly
(D) Tick

11. Lumpy Skin Disease (LSD) is caused by a virus belonging to which of the following genera?
(A) Orthopoxvirus
(B) Capripoxvirus
(C) Aphthovirus
(D) Pestivirus

12. Consider the following statements regarding Lumpy Skin Disease (LSD):
I. It is primarily transmitted by blood-feeding insect vectors such as mosquitoes, ticks, and biting flies.
II. It is characterized by the sudden appearance of firm, circumscribed nodules on the skin.
III. Enlargement of superficial lymph nodes is a common clinical sign.
IV. It is a highly contagious zoonotic disease that spreads easily to human handlers.
Which of the above statement(s) is/are correct?
(A) I, II, and IV only
(B) I, II, and III only
(C) II, III, and IV only
(D) I, III, and IV only

13. A condition known as "bottle jaw" (edema under the lower jaw) in sheep and cattle is a characteristic clinical symptom of heavy infestation by which of the following parasites?
(A) Liver fluke (Fascioliasis)
(B) Adult tapeworm infestation
(C) External tick infestation
(D) Common mange mite infection

14. Which of the following is considered an early, visible symptom of sickness in a healthy milch cow?
(A) Continuous chewing of cud and active feeding
(B) Moist, smooth, and dew-covered front muzzle
(C) Cessation of rumination and a dry muzzle
(D) Steady and progressive increase in milk yield

15. The cessation of rumination (chewing the cud) in cattle is an indicator of:
(A) Optimal digestion and fermentation of roughage
(B) Overhydration due to excessive water intake
(C) Imminent estrus or normal behavioral heat cycle
(D) Systemic illness or severe digestive disorder

16. In the diagnosis of animal diseases, which of the following methods provides the most definitive confirmation of a specific bacterial infection?
(A) Daily recording and monitoring of body temperature
(B) Routine visual observation of herd feeding behavior
(C) Isolation and laboratory culture of the pathogen
(D) Physical auscultation of normal rumen sounds

17. Given below are two lists. Match List I with List II:
List I: Disease
P. Foot and Mouth Disease
Q. Haemorrhagic Septicaemia
R. Babesiosis
S. Fascioliasis
List II: Causal Agent Category
1. Bacteria
2. Virus
3. Helminth (Worm)
4. Protozoa
Select the correct option:
(A) P-2, Q-1, R-4, S-3
(B) P-1, Q-2, R-3, S-4
(C) P-2, Q-1, R-3, S-4
(D) P-4, Q-3, R-2, S-1

18. A subnormal body temperature in an animal suffering from a severe acute infectious disease usually indicates:
(A) The animal is recovering rapidly
(B) The medication has successfully eradicated the fever
(C) The animal is entering a dormant state
(D) The onset of terminal shock and imminent death

19. During the physical examination of a sick animal, a veterinarian records the TPR. What does TPR stand for in veterinary practice?
(A) Temperature, Pulse, Respiration
(B) Total Protein and Nutrient Requirement
(C) Tissue Pathology and Diagnostic Rate
(D) Treatment Progression and Recovery Record

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62. (C) Drone
Drones are male honey bees that develop exclusively from unfertilized eggs through arrhenotokous parthenogenesis, making them haploid organisms carrying only maternal genetic material. In contrast, female honey bees—comprising both fertile queens and sterile workers—develop from fertilized diploid eggs containing genetic material from both a queen mother and a drone father.

63. (D) Food source distance and direction
The wagtail dance is a complex communication behavior performed by returning worker bees inside the hive. The angle of the figure-eight dance run relative to gravity indicates the direction of a distant nectar or pollen source relative to the sun, while the duration of the waggle phrase signals distance precisely.

64. (C) Apis mellifera
Apis mellifera is native to Europe, Africa, and western Asia, making it an exotic introduced species in Asian apiculture. Conversely, Apis dorsata (giant rock bee), Apis florea (little bee), and Apis cerana (Asian hive bee) are indigenous honey bee species native to the Indian subcontinent and surrounding Asian regions naturally.

65. (B) Secchi disc
A Secchi disc is an aquatic instrument specifically used in fisheries and pond management to assess water clarity and plankton density. In contrast, queen excluders, honey extractors, and uncapping knives are specialized tools designed and utilized exclusively in apiaries for beehive management and harvesting and processing honey products efficiently.

66. (D) Nosema - Protozoa
Nosema disease in honey bees is caused by microsporidian protozoan parasites, specifically Nosema apis and Nosema ceranae, which infect the intestinal midgut lining of adult bees. In contrast, American Foulbrood is caused by spore-forming bacteria, Sacbrood is caused by a viral pathogen, and Chalkbrood is triggered by fungal infections directly.

67. (A) Beekeeping and honey
The "Sweet Revolution" is a national initiative spearheaded by the Government of India to promote scientific beekeeping and boost honey production. It aims to enhance rural farm incomes, generate self-employment opportunities, expand hive product exports, and boost agricultural productivity across flowering crops through enhanced natural cross-pollination services provided by honey bees.

68. (C) Seal cracks and hive openings
Propolis is a sticky resinous mixture gathered by worker bees from tree buds and botanical exudates. Bees combine propolis with wax and salivary enzymes to seal cracks, repair structural gaps, smooth hive walls, restrict unwanted drafty air, and sanitize hive interiors due to its potent antimicrobial and antifungal chemical properties.

69. (B) 10
A standard Langstroth beehive brood chamber is structurally engineered to hold exactly 10 wooden frames aligned parallel to each other. These frames maintain precise bee space between adjacent comb surfaces, allowing worker bees to construct uniform wax comb structures for brood rearing, pollen storage, and honey reserves without building irregular burr comb.

70. (D) Continuous floral pasturage to maximize honey yield.
Migratory beekeeping involves systematically transporting bee colonies to different geographical regions following seasonal flowering patterns of various agricultural crops and wild flora. This practice ensures continuous availability of floral nectar and pollen pasturage throughout the year, preventing colony starvation, sustaining colony strength, and maximizing annual commercial honey yields significantly always.

71. (B) Young silkworms up to second instar
Chawki rearing is the specialized scientific management of young silkworms during their first and second instar stages. Because young larvae are extremely delicate and sensitive to temperature, humidity, and leaf quality fluctuations, they require tender chopped mulberry leaves and controlled environmental rearing conditions in specialized Chawki rearing centers always.

72. (C) Thickness or fineness of the silk yarn
Denier is a standardized unit of linear mass density used in the textile and sericulture industry to express the fineness or thickness of silk yarn. One denier equals the mass in grams of

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31. (D) Bombyx mori
Bombyx mori is the domesticated mulberry silkworm species responsible for producing the vast majority of global silk output. It feeds exclusively on leaves of Morus species, primarily Morus alba. Through thousands of years of selective breeding, this species has become completely dependent on human care for survival and offspring reproduction.

32. (A) P-2, Q-4, R-1, S-3
Mulberry silkworms feed on Morus alba, while Tasar silkworms rear on Arjun and Asan trees. Eri silkworms primarily consume castor leaves, and Muga silkworms feed on Som and Soalu trees in northeast India. Matching silkworm types with their respective host plants is vital for effective sericulture management and silk production.

33. (B) Moriculture
Moriculture is the branch of agricultural science dedicated to the cultivation, soil management, pruning, and protection of mulberry plants (Morus species) to harvest foliage for silkworm rearing. In contrast, silviculture focuses on forest trees, arboriculture on individual woody plants, and olericulture on commercial market vegetable crop cultivation practices.

34. (D) Muga silk
Muga silk is a luxurious, naturally golden-yellow silk produced by the semi-domesticated silkworm Antheraea assamensis. It is endemic to the Brahmaputra valley of Assam, India. Renowned for its natural glossy lustre, exceptional durability, and Geographical Indication status, Muga silk thread becomes brighter with every wash without requiring artificial chemical dyeing.

35. (C) I, II and III
Brushing transfers newly hatched larvae to rearing beds, while Chawki rearing involves specialized care for young early-instar larvae. Silkworms cease feeding during moulting periods to shed their exoskeletons. Cocoon spinning is performed exclusively by fully grown fifth-instar silkworm larvae, making the statement attributing spinning to adult moths incorrect completely.

36. (C) Muscardine - Nematode
Muscardine is a silkworm disease caused by fungal pathogens such as Beauveria bassiana (white muscardine) or Metarhizium anisopliae (green muscardine), not by nematodes. In comparison, Pebrine is caused by microsporidian protozoa, Flacherie is associated with bacterial infections, and Grasserie is a viral disease caused by nuclear polyhedrosis virus strains.

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37. (A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
Microscopic examination of mother moths is mandatory in silkworm grainages to detect Nosema bombycis infection. This protozoan causes Pebrine, a catastrophic disease vertically transmitted through eggs from infected female moths to offspring. Identifying and destroying eggs from infected moths eliminates disease transmission, directly explaining the strict screening procedure implemented.

38. (D) Stifling
Stifling involves killing the pupa inside the silkworm cocoon using hot air, steam, or sun drying before adult moth emergence. If the moth emerges, it pierces the cocoon shell, severing continuous silk filaments into short fragments. Stifling preserves long intact silk threads necessary for successful commercial reeling operations downstream.

39. (B) Fibroin and Sericin
Raw silk filaments secreted by silkworms consist of two structural proteins: fibroin and sericin. Fibroin constitutes the inner structural core of twin silk filaments, providing strength and elasticity. Sericin is a water-soluble gummy gelatinous protein that coats and cements fibroin filaments together during cocoon construction before commercial degumming processes.

40. (C) Silk Samagra
Silk Samagra is an integrated Central Sector Scheme introduced by the Government of India to support the comprehensive development of sericulture. It focuses on upgrading silk infrastructure, promoting research and technological innovations, enhancing seed production, expanding market linkages, and improving quality across mulberry, tasar, eri, and muga silk sectors nationwide.

41. (B) 15-16%
Grower mash feed formulated for growing pullets between 9 to 18 weeks of age contains approximately 15% to 16% crude protein.

CHAPTER 32

Animal Disease Diagnosis and Treatment

NODIA

1. Which of the following diseases is classified as a non-infectious nutritional disease in livestock?
(A) Haemorrhagic Septicaemia
(B) Milk Fever
(C) Black Quarter
(D) Foot and Mouth Disease

2. Foot and Mouth Disease (FMD) in cattle is primarily caused by which of the following agents?
(A) A bacterium of the genus Pasteurella
(B) A protozoan parasite of the genus Babesia
(C) A fungus of the genus Aspergillus
(D) A virus belonging to the family Picornaviridae

3. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): Foot and Mouth Disease (FMD) causes severe economic losses to farmers despite having a very low mortality rate in adult cattle.
Reason (R): FMD results in high morbidity, leading to a drastic reduction in milk yield and the working capacity of draft animals.
In the context of the above statements, which of the following is correct?
(A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
(B) Both Assertion (A) and Reason (R) are true but R is not the correct explanation of A.
(C) Assertion (A) is true but Reason (R) is false.
(D) Assertion (A) is false but Reason (R) is true.

4. Which of the following bacterial pathogens is responsible for causing Haemorrhagic Septicaemia (HS) in cattle and buffaloes?
(A) Clostridium chauvoei
(B) Bacillus anthracis
(C) Pasteurella multocida
(D) Mycobacterium bovis

5. Consider the following statements regarding the symptoms of Black Quarter (BQ) in cattle:
I. Crepitating (crackling) sound is produced upon pressing the swollen muscles of the hindquarters.
II. The animal suffers from severe lameness in the affected leg.
III. The disease mostly affects older animals above 5 years of age.
Which of the above statement(s) is/are correct?
(A) I and II only
(B) II and III only
(C) I and III only
(D) I, II, and III

6. Among the following infectious diseases of livestock, which one is caused by a virus rather than a bacterium?
(A) Black Quarter
(B) Haemorrhagic Septicaemia
(C) Anthrax
(D) Lumpy Skin Disease

7. What is the recommended frequency of booster vaccination for Foot and Mouth Disease (FMD) in adult cattle?
(A) Once every month
(B) Once every three months
(C) Once every six months
(D) Once every three years

8. Outbreaks of Haemorrhagic Septicaemia (HS) in buffaloes are most commonly triggered by which of the following environmental conditions?
(A) Prolonged exposure to extreme dry summer heat
(B) Extended periods of high altitude grazing
(C) Heavy monsoon rains and severe waterlogging
(D) Continuous feeding of dry fodder in winter

9. Identify the correct statement regarding Black Quarter (BQ) disease in livestock.
(A) It is primarily a respiratory disease transmitted through droplet infection.
(B) It is a viral disease that can be treated successfully with antivirals.
(C) It only affects pregnant cows during the last trimester.
(D) The causal organism is a soil-borne, spore-forming bacterium.

welfare for fishermen and fish farmers across the country effectively.

52. (B) I, II and IV
High plankton blooms cause elevated night respiration, resulting in nocturnal oxygen depletion. Un-ionized ammonia must remain below 0.1 ppm to prevent tissue damage, and water temperature directly regulates metabolic rates in cold-blooded fish. Moderate alkalinity buffers pH fluctuations, promoting zooplankton growth rather than completely stunting their biological development overall.

53. (C) 10 to 15 cm
In aquaculture terminology, fish seed stages advance from hatchling to fry, then to fingerling. A fingerling represents an advanced seed stage measuring roughly 10 to 15 cm in length, usually reached after 30 to 60 days of fry nursery management. Fingerlings possess fully developed scales and fins, ensuring higher survival upon stocking.

54. (A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
In integrated poultry-fish farming, dropping poultry manure directly into fish ponds provides rich organic nitrogen and phosphorus. This nutrient influx fuels abundant phytoplankton and zooplankton production, supplying natural live food for cultured fish. Consequently, direct manure application satisfies pond fertilization requirements, eliminating the need for expensive chemical fertilizers entirely.

55. (B) It prohibits spawning of Major Carps in hatcheries.
Induced breeding involves injecting hormone preparations such as pituitary gland extracts or synthetic analogues like Ovaprim to induce controlled spawning of Indian Major Carps in hatcheries. Rather than prohibiting spawning, induced breeding revolutionized freshwater fish seed production by ensuring reliable, timely supplies of pure, disease-free fish seed independent of wild monsoon collection.

56. (C) Clarias batrachus (Magur)
Clarias batrachus, commonly known as Magur, is an air-breathing catfish possessing accessory respiratory organs that enable it to absorb atmospheric oxygen directly. This biological adaptation allows Magur to thrive in oxygen-depleted, shallow, muddy, or derelict water bodies where typical carp species like Rohu, Common carp, or Grass carp cannot survive.

57. (D) Water transparency
A Secchi disc is a circular plastic or metal plate divided into alternating black and white quadrants. Suspended into pond water by a calibrated line, it measures light penetration and water transparency. This reading indirectly reflects plankton density or suspended clay turbidity, serving as a simple tool for monitoring water quality in aquaculture.

58. (A) Unmanaged predatory and weed fishes
Unmanaged predatory and weed fishes pose a significant biological constraint in rural fish culture. Weed fishes compete aggressively for natural food and oxygen, while predatory species consume stocked carp fry and fingerlings, dramatically lowering survival rates and overall yield if ponds are not thoroughly cleared and eradicated prior to stocking.

59. (B) 40 : 30 : 30
In a standard three-species Indian Major Carp polyculture system, the recommended stocking density ratio is 40% Catla (surface feeder), 30% Rohu (column feeder), and 30% Mrigal (bottom feeder). This proportional distribution optimizes primary productivity across all vertical pond water layers, minimizing intra-specific and inter-specific food competition among fishes effectively.

60. (B) I and III only
The Blue Revolution aims to double the income of fishers and aquaculture farmers through technological modernization, infrastructure investment, value chain integration, and enterprise development. It emphasizes balanced development across both inland aquaculture and marine capture fisheries rather than abandoning agriculture or replacing freshwater farming entirely with open marine capture fisheries.

61. (A) L.L. Langstroth
Lorenzo Lorraine Langstroth discovered the principle of "Bee Space," identifying that honey bees maintain a specific gap of 6 to 9 millimeters between combs. Utilizing this spatial concept, he invented the top-opening movable frame hive in 1851, enabling frame inspection and honey extraction without destroying comb structures or injuring bees.

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20. Identify the incorrect statement regarding ascariasis (roundworm infestation) in young calves.
(A) It consistently causes stunted growth and an unthrifty overall body appearance.
(B) Affected young calves frequently exhibit a typical pot-bellied body appearance.
(C) It is a viral disease requiring mandatory calf vaccination.
(D) It can be effectively managed by administering a suitable anthelmintic like piperazine.

21. Which laboratory diagnostic test is most essential for identifying blood protozoan diseases such as Theileriosis and Trypanosomiasis in dairy animals?
(A) Microscopic blood smear examination
(B) Routine fecal examination using the flotation method
(C) Diagnostic California Mastitis Test (CMT) in field conditions
(D) Qualitative Milk Ring Test (MRT) on bulk tank samples

22. Arrange the following steps of a standard clinical examination of a sick animal in the correct scientific order:
I. Physical examination (palpation, percussion, auscultation)
II. Collection of animal history from the owner
1III. Laboratory testing of collected samples
IV. General visual observation of the animal from a distance
Select the correct arrangement:
(A) II, IV, I, III
(B) I, II, IV, III
(C) II, I, IV, III
(D) IV, II, I, III

23. The California Mastitis Test (CMT) is a rapid field test primarily used for the diagnosis of which condition in dairy cattle?
(A) Acute clinical mastitis with visible blood clots in milk
(B) Sub-clinical mastitis via somatic cell count
(C) Presence of harmful antibiotic residues in bulk milk
(D) Total fat and solid-not-fat percentage in milk

24. What is the most appropriate first step in the management and timely treatment of an animal showing symptoms of a highly contagious disease?
(A) Administering a broad-spectrum parenteral antibiotic immediately
(B) Calling the local commercial butcher for emergency disposal
(C) Isolating the sick animal from the herd
(D) Vaccinating the entire healthy herd using a single shared needle

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25. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): Prophylactic vaccination against a specific disease is generally not recommended for an animal already suffering from that disease during an outbreak.
Reason (R): Vaccines contain weakened or killed antigens that take time to develop immunity, and administering them to a sick animal imposes additional stress without providing immediate cure.
In the context of the above statements, which of the following is correct?
(A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
(B) Both Assertion (A) and Reason (R) are true but R is not the correct explanation of A.
(C) Assertion (A) is true but Reason (R) is false.
(D) Assertion (A) is false but Reason (R) is true.

26. The National Animal Disease Control Programme (NADCP) was launched with the primary objective of controlling and eventually eradicating which two major diseases?
(A) Foot and Mouth Disease (FMD) and Brucellosis
(B) Rabies and Anthrax
(C) Lumpy Skin Disease (LSD) and Black Quarter (BQ)
(D) Haemorrhagic Septicaemia (HS) and Peste des Petits Ruminants (PPR)

27. As a preventive measure to control the spread of contagious bacterial diseases on a dairy farm, which chemical is most commonly used as an effective floor disinfectant in the animal shed?
(A) Concentrated sodium chloride solution
(B) Bleaching powder
(C) Dilute potassium nitrate solution
(D) Saturated urea solution

28. To collect a blood sample for serum separation to check for antibodies, in which type of collection tube should the blood be drawn?
(A) A sterile blood collection tube containing EDTA
(B) A plain tube without anticoagulant
(C) A sterile blood collection tube containing Heparin
(D) A specialized collection tube containing Sodium Fluoride

29. Consider the following practices:
I. Imposing quarantine on newly purchased animals.
II. Following a regular, timely vaccination schedule.
III. Ensuring hygienic disposal of the carcass of infected animals.
Which of the above statement(s) is/are correct regarding principles of infectious disease prevention on a farm?
(A) I and II only
(B) II and III only
(C) I and III only
(D) I, II, and III

30. Which of the following pairs correctly matches the vaccine with its standard recommended route of administration in cattle?
(A) Foot and Mouth Disease (FMD) vaccine - Direct intravenous (IV) route
(B) Brucella abortus (Strain 19) live vaccine - Standard oral route
(C) Haemorrhagic Septicaemia vaccine - Subcutaneous route
(D) Black Quarter (BQ) bacterial vaccine - Deep intradermal (ID) route

31. Organizing an animal health camp in a rural village provides which of the following primary benefits to local farmers?
(A) It completely eliminates the need for daily feeding of balanced commercial rations to animals.
(B) It legally guarantees a significantly higher baseline market price for all farm milk produce.
(C) It legally mandates all local farmers to sell their livestock directly to the government.
(D) Mass vaccination, deworming, and veterinary care at the doorstep.

32. Which body is responsible for livestock health and disease control administration at the state level in animal husbandry departments?
(A) State Subordinate Services Selection Commission
(B) Indian Veterinary Research Institute
(C) Directorate of Animal Husbandry
(D) State Sugar Corporation

33. Under standard veterinary practices, what is the recommended minimum period for quarantining newly purchased dairy animals before mixing them with the main herd?
(A) 24 to 48 hours
(B) 3 to 5 days
(C) 14 to 21 days
(D) 6 to 8 months

34. Given below are two lists. Match List I with List II:
List I: Diagnostic Test
P. Milk Ring Test (MRT)
Q. Tuberculin Test
R. California Mastitis Test (CMT)
S. Strip Cup Test
List II: Condition Detected
1. Clinical Mastitis
2. Sub-clinical Mastitis
3. Brucellosis
4. Tuberculosis
Select the correct option:
(A) P-3, Q-4, R-2, S-1
(B) P-4, Q-3, R-1, S-2
(C) P-3, Q-4, R-1, S-2
(D) P-2, Q-1, R-4, S-3

35. Bovine mastitis, a disease of significant economic importance, is most frequently caused by bacterial infections belonging to which of the following genera?
(A) Staphylococcus and Streptococcus
(B) Species of Mycobacterium and Clostridium
(C) Pathogens of Pasteurella and Salmonella
(D) Organisms of Brucella and Leptospira

36. Which of the following correctly defines the term 'Quarantine' in animal husbandry?
(A) The immediate slaughter and disposal of animals showing signs of an incurable infectious disease.
(B) The routine preventive administration of broad-spectrum antibiotics to the entire dairy herd.
(C) Isolation and observation of new or suspected

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animals for a set period.
(D) The systematic artificial insemination of healthy cows using high-quality frozen semen straw.

37. At the district level, which institution serves as the highest referral centre providing specialized veterinary services, surgeries, and advanced diagnostics?
(A) State Veterinary Polyclinic
(B) Veterinary Aid Centre (Sub-centre)
(C) Artificial Insemination Centre
(D) Block Veterinary Hospital

38. A mass deworming campaign organized in an animal health camp prior to the onset of the monsoon is primarily aimed at preventing:
(A) Widespread seasonal viral pneumonia outbreaks
(B) Acute magnesium tetany from lush green pasture grass
(C) Acute nutritional rumen bloat in young cattle
(D) Pasture-borne parasitic gastroenteritis

39. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): Sub-clinical mastitis causes far greater overall economic losses to the dairy industry than clinical mastitis.
Reason (R): Sub-clinical mastitis silently reduces milk yield and quality without showing obvious swelling in the udder or physical abnormalities in the milk, often going unnoticed by the farmer.
In the context of the above statements, which of the following is correct?
(A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
(B) Both Assertion (A) and Reason (R) are true but R is not the correct explanation of A.
(C) Assertion (A) is true but Reason (R) is false.
(D) Assertion (A) is false but Reason (R) is true.

40. Which of the following field management practices is most highly recommended immediately after milking to prevent the entry of mastitis-causing pathogens into the udder?
(A) Thoroughly washing the complete udder with clean cold water
(B) Allowing the cow to lie down immediately on unsterilized bedding in the shed
(C) Post-milking teat dipping with germicidal solution
(D) Massaging the entire udder thoroughly using raw unpasteurized mustard oil

41. Brucellosis is a major disease leading to infertility in dairy cattle. What is the most characteristic clinical symptom of Brucellosis in a pregnant cow?
(A) Persistent high fever accompanied by severe continuous coughing
(B) Sudden severe swelling of knee joints leading to permanent lameness
(C) Extensive formation of painful blisters on the tongue and hooves
(D) Abortion during the late stage of pregnancy

42. Parturient paresis, commonly known as Milk Fever in high-yielding dairy cows, is a nutritional disease caused by the sudden deficiency of which mineral in the blood shortly after calving?
(A) Calcium
(B) Phosphorus
(C) Magnesium
(D) Iron

43. The abnormal appetite condition known as 'Pica', where cattle are observed chewing on bones, stones, or soil, is primarily associated with a dietary deficiency of:
(A) Vitamin A complex
(B) Phosphorus
(C) Dietary zinc
(D) Elemental sodium

44. Consider the following first aid measures:
I. Administering an anti-frothing agent like vegetable oil or turpentine oil.
II. Passing a stomach tube to relieve accumulated gas.
III. Tying the animal down tightly on the ground to prevent movement.
IV. Using a trocar and cannula to puncture the left paralumbar fossa in a severe emergency.
Which of the above statement(s) is/are correct regarding providing first aid to an animal suffering from acute bloat (Tympanites)?
(A) I, II, and III only
(B) I, II, and IV only
(C) II, III, and IV only
(D) I, III, and IV only

45. Which of the following is the most accurate definition of a zoonotic disease?
(A) A disease naturally transmissible between vertebrate animals and humans.

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10. (A) Snail
Fasciola hepatica, the liver fluke, requires freshwater mud snails belonging to the family Lymnaeidae as intermediate hosts to complete its life cycle. Miracidia larvae hatch from eggs and infect the snail, developing into cercariae. These encyst on aquatic plants as infectious metacercariae, which livestock ingest while grazing in marshy areas.

11. (B) Capripoxvirus
Lumpy Skin Disease is caused by Lumpy skin disease virus, a member of the Capripoxvirus genus within the Poxviridae family. This double-stranded DNA virus is antigenically related to sheep pox and goat pox viruses. It affects cattle and water buffaloes, resulting in skin nodules, fever, edema, and decreased milk production across infected herds.

12. (B) I, II, and III only
Lumpy Skin Disease causes fever, firm circumscribed skin nodules, and enlarged superficial lymph nodes in affected cattle. It is vector-borne, transmitted mechanically by biting flies, mosquitoes, and ticks. Although it causes severe economic losses in livestock, it is not a zoonotic infection and does not spread to human handlers or farm workers.

13. (A) Liver fluke (Fascioliasis)
Submandibular edema, commonly known as bottle jaw, is a characteristic sign of severe fascioliasis in sheep and cattle. Chronic liver damage caused by migrating Fasciola flukes impairs hepatic function and leads to hypoalbuminemia. Decreased plasma oncotic pressure allows fluid accumulation in dependent subcutaneous tissues, particularly under the lower jaw region.

14. (C) Cessation of rumination and a dry muzzle
In healthy milch cattle, active rumination and a moist, cool muzzle indicate good physiological health and normal digestive function. A sudden cessation of chewing the cud, accompanied by a hot, dry muzzle, serves as an early clinical indicator of systemic illness, digestive disorders, or acute infectious fever in dairy cows.

15. (D) Systemic illness or severe digestive disorder
Chewing the cud, or rumination, is essential for proper microbial fermentation and fiber digestion in ruminants. When an animal experiences fever, systemic pain, metabolic stress, or gastrointestinal disorders, forestomach motility is suppressed. Consequently, the complete cessation of rumination acts as a reliable clinical sign of underlying disease requiring immediate veterinary attention.

16. (C) Isolation and laboratory culture of the pathogen
While physical examination and field observation help detect clinical signs, isolating and culturing the causative organism in a laboratory provides gold-standard confirmation of bacterial infections. Identification of the specific bacterial species allows precise diagnostic confirmation, antimicrobial susceptibility testing, and implementation of targeted antibiotic therapy to manage farm disease outbreaks efficiently.

17. (A) P-2, Q-1, R-4, S-3
Foot and Mouth Disease is caused by an Aphthovirus (virus). Haemorrhagic Septicaemia is caused by Pasteurella multocida (bacteria). Babesiosis is caused by Babesia species, which are blood-borne intraerythrocytic protozoa. Fascioliasis is caused by Fasciola flukes, which belong to the helminth class Trematoda. Matching these causal agents establishes accurate etiology for disease control.

18. (D) The onset of terminal shock and imminent death
In acute infectious conditions, body temperature previously elevated by fever often drops significantly below normal levels when severe cardiovascular collapse and multi-organ failure occur. This subnormal body temperature, or hypothermia, reflects the complete failure of thermoregulatory mechanisms and peripheral circulation, signaling terminal endotoxic shock and imminent death in critically ill livestock.

19. (A) Temperature, Pulse, Respiration
In clinical veterinary medicine, the acronym TPR stands for Temperature, Pulse, and Respiration. These baseline vital signs are systematically measured during standard physical examinations to evaluate an animal's general physiological condition, assess disease severity, monitor ongoing therapeutic responses, and identify early systemic or respiratory abnormalities in domestic farm animals today.

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II. Distributing free milch animals to below-poverty-line farmers.
III. Conducting artificial insemination and minor surgical procedures on the spot.
Which of the above statement(s) is/are correct regarding the primary functions of Mobile Veterinary Units (MVUs)?
(A) I and II only
(B) II and III only
(C) I and III only
(D) I, II, and III

55. What is the name of the IT-enabled system implemented for recording and reporting animal disease outbreaks from the block level to the national level?
(A) Centralized Animal Disease Outbreak Registry System
(B) National Animal Disease Reporting System
(C) Integrated State Veterinary Information Portal System
(D) Comprehensive National Livestock Health Database

56. The growing problem of antibiotic resistance in livestock is primarily caused by:
(A) Continuously feeding excessive amounts of green leguminous fodder to farm animals
(B) Systematically vaccinating young animals against common endemic viral diseases
(C) Indiscriminate use, under-dosing, and incomplete antibacterial treatments
(D) Frequently using traditional natural herbal remedies for external wound healing

57. Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A): Milk produced by a cow actively undergoing treatment with systemic antibiotics must be withheld from human consumption.
Reason (R): Antibiotic residues present in the milk can induce allergic reactions in sensitive consumers and contribute to the development of antimicrobial resistance in human pathogens.
In the context of the above statements, which of the following is correct?
(A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
(B) Both Assertion (A) and Reason (R) are true but R is not the correct explanation of A.
(C) Assertion (A) is true but Reason (R) is false.
(D) Assertion (A) is false but Reason (R) is true.

58. In the context of veterinary disease management, NADRS stands for:
(A) National Animal Disease Reporting System
(B) National Association of Dairy Research Scientists
(C) Nodal Agency for Disease Reduction Strategy
(D) Network for Animal Drug Residue Surveillance

59. A standard Mobile Veterinary Unit (MVU) vehicle operating under government schemes is staffed with which of the following personnel configurations?
(A) One senior administrative officer and two certified transport drivers
(B) One Veterinary Doctor, one Paravet, and one Driver
(C) Two registered Veterinary Doctors and one qualified livestock pharmacist
(D) One senior agricultural extension officer and one heavy vehicle driver

60. The specific time required for the residue of an administered drug (like an antibiotic) to decline below the maximum residue limit in the milk or meat of the treated animal is defined as the:
(A) Incubation period
(B) Withdrawal period
(C) Quarantine period
(D) Latent period

61. Under the National Livestock Mission (NLM), which specific scheme is implemented to provide risk coverage to farmers against the sudden death of their animals due to diseases or accidents?
(A) Pashudhan Bima Yojana
(B) Rashtriya Gokul Mission
(C) Dairy Entrepreneurship Development Scheme
(D) National Animal Disease Control Programme

NODIA

62. To ensure animal welfare and prevent fraud under livestock health insurance schemes, what is the most critical physical requirement at the time of insuring a milch animal?
(A) Painting both horns thoroughly with a designated bright official color
(B) Securing a heavy engraved brass bell tightly around the animal's neck
(C) Affixing a unique polyurethane ear tag
(D) Permanently hot-iron branding the insurance policy number on the flank

63. Under the "Pashu Sanjeevani" component of government schemes, a unique health card is issued to dairy animals containing their identification and health records. What is this card officially named?
(A) Kisan Credit Card
(B) Pashudhan Praman Patra
(C) Gau-Mata Health Card
(D) Nakul Swasthya Patra

64. Given below are two lists. Match List I with List II:
List I: Government Scheme / Programme
P. Pashudhan Bima Yojana
Q. NADCP
R. Rashtriya Gokul Mission
S. Pashu Sanjeevani
List II: Primary Objective
1. Conservation and development of indigenous breeds
2. Issuance of Nakul Swasthya Patra
3. Vaccination against FMD and Brucellosis
4. Providing risk coverage for animal death
Select the correct option:
(A) P-4, Q-3, R-1, S-2
(B) P-3, Q-4, R-2, S-1
(C) P-4, Q-1, R-3, S-2
(D) P-1, Q-2, R-4, S-3

65. Select the correct order of administrative hierarchy for reporting an outbreak of an infectious animal disease, from the ground level upwards:
(A) Chief Veterinary Officer → Veterinary Officer → Livestock Owner → Paravet
(B) Livestock Owner → Paravet / Village Level Worker → Veterinary Officer → Chief Veterinary Officer
(C) Paravet → Chief Veterinary Officer → Livestock Owner → Veterinary Officer
(D) Veterinary Officer → Chief Veterinary Officer → Paravet → Livestock Owner

66. Consider the following steps involved in processing a livestock insurance claim upon the death of an insured animal:
I. Immediate intimation of death to the insurance company and the local veterinary officer.
II. Conducting a post-mortem examination by a qualified registered veterinarian.
III. Submission of the intact ear tag along with the claim form and post-mortem report.
IV. Purchasing a replacement animal before the claim is filed.
Which of the above statement(s) is/are correct regarding necessary steps for a valid insurance claim?
(A) I, II, and IV only
(B) II, III, and IV only
(C) I, II, and III only
(D) I, III, and IV only

67. Under the Pashudhan Bima Yojana, the maximum premium subsidy percentage provided to farmers belonging to the BPL / SC / ST categories is up to:
(A) 25%
(B) 50%
(C) 70%
(D) 100%

68. The epidemiological strategy of "Ring Vaccination" used to control a severe outbreak of Foot and Mouth Disease (FMD) involves:
(A) Vaccinating only actively sick animals showing clinical symptoms within a farm circle
(B) Administering a booster vaccine to animals strictly once during their entire lifetime
(C) Vaccinating healthy animals within a radius of the outbreak center
(D) Administering the liquid vaccine in a slow circular motion directly on the animal's skin

69. Ketosis is a non-infectious metabolic disease commonly seen in high-yielding dairy cattle during early lactation. It is primarily caused by:
(A) Negative energy balance causing hypoglycemia and fat breakdown
(B) Prolonged exposure to extreme high ambient temperatures during hot summer months
(C) Excessive, uncontrolled feeding of calcium-rich mineral mixtures and concentrates
(D) Chronic systemic viral infection directly affecting liver tissue functionality

70. Consider the following diseases of livestock:
I. Brucellosis
II. Rabies
III. Haemorrhagic Septicaemia
Which of the above statement(s) is/are correct regarding diseases classified as zoonotic?
(A) I and II only
(B) II and III only
(C) I and III only
(D) I, II, and III

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71. Outbreaks of Haemorrhagic Septicaemia (HS) show a strong seasonal occurrence. The disease is most widely prevalent during:
(A) The peak period of dry winter months (December to January)
(B) Monsoon and pre-monsoon periods
(C) The spring crop harvest season (March to April)
(D) The early autumn transitional season (October to November)

72. During the post-mortem of an animal that died of Black Quarter (BQ), what is the most characteristic lesion found in the heavily muscled areas?
(A) Severely congested lungs completely filled with clear inflammatory serous fluid
(B) Small and large intestines severely congested and heavily filled with dark blood
(C) Dark, spongy muscle tissue emitting a rancid butter odor
(D) Markedly enlarged, friable liver tissue showing extensive parasite fluke tracts

73. Select the correct order of veterinary institutional hierarchy, arranged from the lowest rural tier to the specialized district/regional tier:
(A) Polyclinic → Veterinary Hospital → Sub-centre
(B) Sub-centre → Veterinary Hospital → Polyclinic
(C) Veterinary Hospital → Sub-centre → Polyclinic
(D) Sub-centre → Polyclinic → Veterinary Hospital

74. Identify the correct statement regarding Lumpy Skin Disease (LSD) in cattle.
(A) Poxviridae virus causing high fever followed by cutaneous skin nodules.
(B) The disease is strictly water-borne and spreads rapidly when animals consume contaminated water.
(C) It consistently causes nearly 100% mortality in all infected adult cattle within a short 48-hour period.
(D) Goats and sheep act as the primary natural disease reservoirs and heavily suffer severe clinical disease.

75. What is the standard recommended deworming schedule for adult cattle to effectively manage internal parasitic loads (like gastrointestinal nematodes) under field conditions?
(A) Continuously administered once every single week throughout the year
(B) Twice yearly, pre- and post-monsoon
(C) Administered strictly only once during the entire lifetime of the animal
(D) Administered daily on a routine basis during peak summer months

76. Which of the following early symptoms is typically the first reason a dairy farmer suspects an infectious disease like FMD or HS in a lactating cow, even before severe clinical signs manifest?
(A) Progressive swelling of the lower hind legs
(B) Sudden drop in milk yield
(C) Excessive uncharacteristic growth of body hair
(D) Noticeable changes in the colour of the coat

77. The Strip Cup Test is a basic diagnostic tool that a farmer can use daily at the farm level. What is its primary function?
(A) To visually detect clots, flakes, or watery milk from clinical mastitis
(B) To accurately determine the exact Specific Gravity and density of fresh milk
(C) To precisely measure the exact butterfat percentage of freshly drawn raw milk
(D) To monitor and check the exact physical temperature of milk immediately after milking

78. In the context of basic animal first aid, what is the most appropriate initial action to control severe arterial bleeding from a deep cut on a cow's lower leg?
(A) Apply raw dry cow dung directly over the deep wound to quickly seal it
(B) Immediately administer a fast intravenous therapeutic injection of calcium
(C) Apply a pressure bandage above the bleed point
(D) Leave the bleeding wound uncovered to air-dry and allow natural clotting

79. Cystic Ovarian Disease (COD) is a major cause of infertility in high-producing dairy cows. What behavioural symptom is frequently exhibited by a cow suffering from follicular cysts?
(A) Complete loss of appetite accompanied by severe physical lethargy
(B) Highly aggressive charging behavior towards humans with a frothy mouth
(C) Severe continuous shivering combined with

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(B) A persistent disease that is transmitted exclusively through the bite of an insect vector.
(C) A severe metabolic disease caused by specific nutritional deficiencies in captive zoo animals.
(D) A non-infectious congenital disease passed directly from a parent animal to its offspring.

46. Rabies is a fatal zoonotic disease. How is the rabies virus primarily transmitted from an infected animal to a human?
(A) Through the direct consumption of unpasteurized raw milk from the infected animal
(B) Through inhalation of respiratory aerosolized particles within the animal shed
(C) Bite of an infected animal introducing saliva into a wound
(D) Through the ingestion and consumption of improperly cooked infected meat

47. Given below are two lists. Match List I with List II:
List I: Nutritional Deficiency
P. Calcium deficiency
Q. Phosphorus deficiency
R. Magnesium deficiency
S. Vitamin E / Selenium deficiency
List II: Disease / Condition
1. Grass Tetany
2. White Muscle Disease
3. Milk Fever
4. Pica
Select the correct option:
(A) P-3, Q-4, R-1, S-2
(B) P-4, Q-3, R-2, S-1
(C) P-3, Q-1, R-4, S-2
(D) P-1, Q-2, R-3, S-4

48. In animal first aid, what is the purpose of flushing a fresh, bleeding wound with a dilute solution of Potassium Permanganate (KMnO4)?
(A) To act as a powerful local anesthetic agent to immediately reduce severe surgical pain
(B) To permanently seal and cauterize the damaged blood vessels in deep tissues
(C) To act as a mild antiseptic, clean debris, and aid hemostasis
(D) To rapidly dissolve and digest necrotic tissue deep within the damaged muscle layer

49. In the context of bovine infertility, a "repeat breeder" is technically defined as a cow that:
(A) Has completely stopped producing milk during the first three months of active lactation
(B) Fails to conceive after 3 or more proper inseminations despite regular cycles
(C) Continuously shows highly abnormal estrus cycles that are consistently shorter than 10 days
(D) Has successfully delivered healthy twin calves in two consecutive pregnancies

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50. Among the following zoonotic diseases, which one requires a strict exception to standard post-mortem practices, dictating that the carcass of the suspected animal must NOT be opened in the field due to the risk of environmental sporulation?
(A) Tuberculosis
(B) Brucellosis
(C) Leptospirosis
(D) Anthrax

51. Under the National Animal Disease Control Programme (NADCP), the target year to achieve total eradication of Foot and Mouth Disease (FMD) is:
(A) 2025
(B) 2030
(C) 2035
(D) 2040

52. To monitor vaccination and disease status under the National Animal Disease Control Programme (NADCP), every vaccinated animal must be identified with an ear tag bearing a unique 12-digit number. This data is uploaded to which database?
(A) E-Pashuhaat portal
(B) AGMARKNET portal
(C) INAPH database
(D) NADRS portal

53. To provide veterinary services at the doorstep in remote areas, government-operated Mobile Veterinary Units (MVUs) use which centralized toll-free helpline number in India?
(A) 1090
(B) 1962
(C) 1076
(D) 108

54. Consider the following functions:
I. Providing primary disease diagnosis and treatment at the farmer's doorstep.

ANSWERS

1. (B) Milk Fever
Milk fever, or parturient paresis, is a metabolic disorder in dairy cows caused by an acute calcium deficiency following calving. Unlike infectious diseases transmitted by pathogens, it stems purely from nutritional and physiological imbalances during early lactation. Proper nutritional management, including dietary cation-anion balance before calving, helps prevent this non-contagious condition effectively in high-yielding cattle.

2. (D) A virus belonging to the family Picornaviridae
Foot and Mouth Disease is a highly contagious viral illness that affects cloven-hoofed animals like cattle, sheep, and pigs. It is caused by an Aphthovirus within the Picornaviridae family. The disease causes fever, painful blisters on the tongue, lips, and hooves, leading to severe lameness, reduced feed intake, and significant loss of productivity across affected herds.

3. (A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
Foot and Mouth Disease exhibits extremely high morbidity, spreading rapidly through susceptible livestock populations. While mortality in adult cattle remains low, the infection causes severe lesions in the mouth and feet. This impairs feeding and mobility, leading to drastic drops in milk production, reduced draft capacity, and long-term economic losses for dairy farmers.

4. (C) Pasteurella multocida
Haemorrhagic Septicaemia is an acute, fatal bacterial disease primarily affecting cattle and water buffaloes. It is caused by Pasteurella multocida, particularly serotypes B:2 and E:2. The infection is characterized by high fever, painful throat swelling, severe respiratory distress, and rapid progression to fatal septicemia, often triggered by environmental stress during monsoon seasons.

5. (A) I and II only
Black Quarter is an acute infectious disease caused by Clostridium chauvoei, mainly targeting young cattle aged six months to two years. It leads to inflammation of heavy muscles, causing severe lameness. Pressing affected hindquarter muscles produces a characteristic crepitating sound due to gas accumulation, whereas animals older than five years rarely acquire this infection.

6. (D) Lumpy Skin Disease
Lumpy Skin Disease is a viral infection affecting cattle, caused by a Capripoxvirus in the Poxviridae family. In contrast, Black Quarter, Haemorrhagic Septicaemia, and Anthrax are bacterial diseases caused by Clostridium chauvoei, Pasteurella multocida, and Bacillus anthracis, respectively. Recognizing etiology is essential for accurate field diagnosis and effective disease control measures.

7. (C) Once every six months
Controlling Foot and Mouth Disease in endemic regions relies on maintaining high herd immunity through regular vaccination. Adult cattle require biannual booster vaccinations given every six months using a polyvalent inactivated FMD vaccine. Following this strict bi-annual schedule protects livestock against circulating serotypes and minimizes disease transmission across cattle populations.

8. (C) Heavy monsoon rains and severe waterlogging
Haemorrhagic Septicaemia outbreaks in cattle and water buffaloes occur most frequently during the rainy monsoon season. Environmental factors such as high humidity, severe waterlogging, sudden temperature changes, and heavy farm work induce physical stress. This stress lowers immunity and facilitates the multiplication and rapid transmission of Pasteurella multocida among susceptible livestock.

9. (D) The causal organism is a soil-borne, spore-forming bacterium.
Black Quarter is caused by Clostridium chauvoei, an anaerobic, spore-forming bacterium. The spores persist in the soil for long periods and infect animals through ingestion of contaminated pasture or entry into skin wounds. Once inside muscle tissue, dormant spores germinate, producing toxins that lead to severe necrotizing myositis and fatal systemic illness.

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dragging of both hind limbs
(D) Nymphomania (frequent signs of estrus)

80. The term 'Biosecurity' in a modern dairy or livestock farm is best defined as:
(A) The administrative practice of purchasing comprehensive health insurance for the entire herd.
(B) The mandatory legal documentation required when transporting livestock across regional borders.
(C) Practices designed to prevent disease entry and spread on a farm.
(D) The deployment of physical barriers and security guards to prevent the theft of livestock.

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20. (C) It is a viral disease requiring mandatory calf vaccination.
Ascariasis in young calves is caused by Toxocara vitulorum, a parasitic nematode rather than a virus. Heavy worm loads cause intestinal obstruction, leading to stunted growth, rough hair coat, and a characteristic pot-bellied appearance. Anthelmintics such as piperazine or albendazole effectively eliminate roundworms, rendering viral vaccination inapplicable for this helminthic infection.

21. (A) Microscopic blood smear examination
Hemoprotozoan diseases like Theileriosis and Trypanosomiasis are definitively diagnosed in field conditions by microscopic examination of stained blood smears. Preparing thin or thick blood films stained with Giemsa stain allows direct visualization of intraerythrocytic protozoa such as Theileria piroplasms or extracellular Trypanosoma flagellates in blood, facilitating prompt anti-protozoal therapeutic treatment.

22. (A) II, IV, I, III
A systematic clinical examination begins with gathering detailed animal history from the owner, followed by general visual observation from a distance to note posture and behavior. Next, a close hands-on physical examination incorporating palpation, percussion, and auscultation is performed. Finally, laboratory testing of collected biological samples confirms definitive diagnostic findings.

23. (B) Sub-clinical mastitis via somatic cell count
The California Mastitis Test is a rapid, point-of-care diagnostic tool used to detect sub-clinical mastitis in cows. The reagent reacts with DNA from somatic cells in milk to form a gel-like mixture. The viscosity of the reaction directly reflects somatic cell counts, enabling early identification of hidden intramammary udder infections.

24. (C) Isolating the sick animal from the herd
When an animal displays symptoms of a highly contagious disease, immediate physical isolation from the rest of the herd is the crucial initial disease control measure. Isolation prevents direct physical contact and aerosol transmission to healthy animals, limiting pathogen spread across the farm while awaiting professional veterinary diagnosis and treatment.

25. (A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
Prophylactic vaccines require several days or weeks to induce active immune responses by eliciting antibody production. Administering a vaccine to an already infected animal imposes additional metabolic stress without offering immediate therapeutic benefit. Therefore, vaccination is strictly preventive and contraindicated during an active acute infection in affected individual farm livestock.

26. (A) Foot and Mouth Disease (FMD) and Brucellosis
The National Animal Disease Control Programme is a major flagship initiative launched by the Government of India. It aims to fully control and eventually eradicate Foot and Mouth Disease and Brucellosis through 100% compulsory mass vaccination of eligible cattle, buffalo, sheep, goat, and pig populations, mitigating severe economic and production losses nationwide.

27. (B) Bleaching powder
Bleaching powder, or calcium hypochlorite, is widely used as an economical and potent floor disinfectant in animal housing premises. Releasing active chlorine upon reaction with moisture effectively destroys pathogenic bacteria, viruses, and fungi present on farm surfaces, maintaining vital biosecurity and reducing infectious disease transmission among housed dairy herd livestock.

28. (B) A plain tube without anticoagulant
For serological evaluations such as antibody detection, blood must be collected in a plain tube without anticoagulants. Allowing the blood sample to clot naturally causes fibrin networks to trap blood cells, permitting separation of clear serum after centrifugation, which is required for serological antibody testing and diagnostic chemical analyses.

29. (D) I, II, and III
Effective infectious disease prevention relies on three core principles. Quarantining newly introduced livestock prevents entering pathogens from spreading to resident animals. Regular vaccination schedules boost specific immunity against endemic diseases. Proper hygienic carcass disposal of deceased infected animals eliminates environmental contamination and effectively disrupts pathogen transmission cycles across dairy farms.

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30. (C) Haemorrhagic Septicaemia vaccine - Subcutaneous route
Haemorrhagic Septicaemia vaccine, typically an alum-precipitated or oil-adjuvanted bacterin, is standardly administered via the subcutaneous route in cattle, usually in the mid-neck region. Proper subcutaneous injection ensures gradual antigen absorption, producing an effective protective immune response against Pasteurella multocida without causing severe local tissue reactions.

31. (D) Mass vaccination, deworming, and veterinary care at the doorstep.
Rural animal health camps provide comprehensive veterinary services directly to livestock owners in remote areas. These health camps organize mass vaccination drives against endemic infectious diseases, administer systematic deworming treatments, treat clinical ailments, and educate local farmers on modern herd health management without requiring long distance transport of animals.

32. (C) Directorate of Animal Husbandry
At the state government level, the Directorate of Animal Husbandry functions as the primary administrative body responsible for livestock development and disease control. It manages statewide veterinary infrastructure, executes state and central government schemes, coordinates mass vaccination programs, and supervises veterinary hospitals and polyclinics across all districts.

33. (C) 14 to 21 days
Under standard biosecurity protocols, newly acquired livestock should be isolated in quarantine for 14 to 21 days before joining the resident herd. This observation period covers the incubation timeframe for most infectious livestock diseases, allowing latent infections to manifest and ensuring animals are properly health-screened, vaccinated, and thoroughly dewormed.

34. (A) P-3, Q-4, R-2, S-1
Milk Ring Test screens bulk milk samples for bovine Brucellosis antibodies. The Tuberculin Test detects delayed-type hypersensitivity to Mycobacterium bovis in tuberculosis screening. The California Mastitis Test assesses somatic cell counts to detect sub-clinical mastitis, while the Strip Cup Test detects physical milk abnormalities like clots, confirming active clinical mastitis.

35. (A) Staphylococcus and Streptococcus
Bovine mastitis is an inflammatory condition of the mammary gland primarily caused by bacterial pathogens. Bacterial species belonging to Staphylococcus (such as Staphylococcus aureus) and Streptococcus (such as Streptococcus agalactiae and Streptococcus uberis) are the predominant causative agents, leading to significant reductions in milk yield and economic farm revenue.

36. (C) Isolation and observation of new or suspected animals for a set period.
Quarantine in animal husbandry refers to the strict physical isolation and health monitoring of newly purchased or disease-suspected animals for a specified period. This practice prevents the introduction of contagious pathogens into a healthy herd, allowing latent infectious conditions to be detected, tested, and treated before introducing new herd stock.

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37. (A) State Veterinary Polyclinic
At the district level, the District or State Veterinary Polyclinic acts as the highest referral veterinary facility. It is equipped with specialized diagnostic units, advanced surgical facilities, clinical pathology laboratories, and specialized veterinary officers to manage complex clinical, surgical, and reproductive cases referred from lower-tier field dispensaries and local hospitals.

38. (D) Pasture-borne parasitic gastroenteritis
Organizing mass deworming campaigns before the monsoon season targets internal parasites like helminths in livestock. Warm, moist monsoon weather favors the survival and hatching of parasite larvae on pasture grass. Deworming prior to rains reduces internal worm burdens, preventing heavy parasitic gastroenteritis, anemia, and production loss in grazing farm animals.

39. (A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
Sub-clinical mastitis causes significant financial losses in the dairy sector because it lacks visible inflammation in the udder or physical changes in milk. The infection causes persistent, unnoticed drops in overall milk production and alters milk composition across herds. Without routine

screening like somatic cell counting, it remains undetected and untreated.

40. (C) Post-milking teat dipping with germicidal solution
Following milking, the teat sphincter muscle remains dilated for approximately 30 to 45 minutes, creating an open pathway for environmental bacteria to enter the teat canal. Applying a post-milking germicidal teat dip coats the skin and teat orifice, destroying contaminating microorganisms and forming a protective barrier against environmental mastitis pathogens.

41. (D) Abortion during the late stage of pregnancy
Bovine Brucellosis, caused by Brucella abortus, is a bacterial disease targeting reproductive organs. The bacterium localizes in the placenta and gravid uterus, causing severe placentitis. This impairs nutrient transport to the fetus, leading characteristically to contagious abortion during the last trimester of pregnancy, followed by retained placenta and chronic infertility.

42. (A) Calcium
Milk fever, or parturient paresis, is a metabolic disorder caused by acute hypocalcemia shortly after calving. The sudden onset of intense lactation drains blood calcium into colostrum faster than homeostatic mechanisms can mobilize calcium from bones or absorb it from intestines, resulting in muscle weakness, sternal recumbency, and flaccid paralysis.

43. (B) Phosphorus
Pica is a depraved appetite where livestock ingest non-nutritive substances like soil, bones, wood, or stones. In cattle, chronic dietary phosphorus deficiency is the primary cause of pica. Deficient animals exhibit abnormal chewing behavior, reduced feed efficiency, bone malformations, poor growth rates, and compromised reproductive performance on low-phosphorus grazing pastures.

44. (B) I, II, and IV only
Acute bloat involves excessive gas accumulation in the rumen. Administering anti-frothing agents like oils breaks down stable foam, while passing a stomach tube vents trapped free gas. In severe life-threatening bloat emergencies, puncturing the left paralumbar fossa with a trocar and cannula quickly releases gas, whereas tying down the animal worsens distress.

45. (A) A disease naturally transmissible between vertebrate animals and humans.
Zoonotic diseases, or zoonoses, are infectious conditions caused by bacteria, viruses, parasites, or fungi that naturally transmit between vertebrate animals and humans. Transmission occurs through direct contact, consumption of contaminated animal food products, or vector-borne pathways, highlighting the critical importance of synchronized veterinary and public health disease control interventions.

46. (C) Bite of an infected animal introducing saliva into a wound
Rabies is a neurotropic viral infection caused by a Lyssavirus. The virus is excreted in large amounts in the saliva of clinically infected animals. Transmission primarily occurs through bites or scratches that break skin integrity, introducing virus-laden saliva into tissues, where it travels along peripheral nerves to the central nervous system.

47. (A) P-3, Q-4, R-1, S-2
Calcium deficiency in post-calving cows causes Milk Fever. Phosphorus deficiency results in pica, characterized by depraved appetite for bones or soil. Magnesium deficiency triggers Grass Tetany, leading to hypomagnesemic neuromuscular hyperexcitability. Combined Vitamin E and Selenium deficiency causes White Muscle Disease, resulting in degenerative nutritional myopathy in young farm livestock.

48. (C) To act as a mild antiseptic, clean debris, and aid hemostasis
Dilute Potassium Permanganate (1:1000 solution) is used in veterinary first aid for wound lavage. Its oxidizing action releases oxygen, serving as an effective mild antiseptic against anaerobic microorganisms. It cleans tissue debris and dirt from fresh wounds while exerting mild astringent and hemostatic effects to assist in controlling minor bleeding.

49. (B) Fails to conceive after 3 or more proper inseminations despite regular cycles
In bovine reproduction, a repeat breeder cow is defined as an animal that exhibits regular, normal estrous cycles every 18 to 24 days but fails to conceive after three or more consecutive, high-quality artificial inseminations or natural breedings, despite presenting no detectable

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intake. This negative energy balance leads to hypoglycemia, forcing mobilization of body fat reserves. Excess fatty acid oxidation in the liver yields ketone bodies like acetoacetate and beta-hydroxybutyrate, causing clinical bovine ketosis.

70. (A) I and II only
Brucellosis (caused by Brucella species) and Rabies (caused by Rabies virus) are established zoonotic diseases that readily transmit from infected livestock to humans through direct contact, infected secretions, or animal bites. In contrast, Haemorrhagic Septicaemia (caused by Pasteurella multocida serotypes B:2/E:2) primarily affects cattle and water buffaloes without posing significant zoonotic risk.

71. (B) Monsoon and pre-monsoon periods
Haemorrhagic Septicaemia outbreaks exhibit marked seasonal occurrence, peaking during monsoon and pre-monsoon periods. High environmental humidity, heavy rainfall, severe waterlogging, sudden temperature fluctuations, and physical stress from field work compromise livestock immunity, favoring rapid bacterial proliferation and oral or aerosol transmission of Pasteurella multocida among cattle and buffalo populations.

72. (C) Dark, spongy muscle tissue emitting a rancid butter odor
Post-mortem examination of an animal that died of Black Quarter reveals pathognomonic lesions in heavy muscles of the thigh or shoulder. Affected muscular tissue appears dark, dry, crepitant, and spongy due to gas bubbles produced by Clostridium chauvoei, releasing a characteristic odor of rancid butter caused by butyric acid fermentation.

73. (B) Sub-centre → Veterinary Hospital → Polyclinic
The institutional hierarchy of public veterinary services in India advances from primary local tiers to specialized referral centers. Veterinary Sub-centres function at the grassroots village level for basic treatment and artificial insemination, referring cases to Block-level Veterinary Hospitals, which escalate complex diagnostic and surgical cases to District Veterinary Polyclinics nationwide.

74. (A) Poxviridae virus causing high fever followed by cutaneous skin nodules.
Lumpy Skin Disease is caused by Lumpy skin disease virus, a member of the Poxviridae family (genus Capripoxvirus). Clinical signs include high fever, ocular and nasal discharge, localized edema, and the rapid eruption of firm, circumscribed cutaneous nodules across the skin. The virus primarily affects cattle and water buffalo populations.

75. (B) Twice yearly, pre- and post-monsoon
Under practical farm health management, adult cattle should be dewormed twice annually, specifically prior to and following the monsoon season. Pre-monsoon anthelmintic administration eliminates existing adult gastrointestinal nematodes before favorable parasite transmission weather, while post-monsoon deworming clears accumulated worm burdens acquired from grazing heavily contaminated pastures during peak rainfall periods.

76. (B) Sudden drop in milk yield
In lactating cattle, a sudden, sharp decline in daily milk yield is often the earliest sensitive indicator of disease onset. Physiological stress, systemic fever, and acute inflammation from viral or bacterial infections impair lactogenesis and milk letdown before physical symptoms like vesicles, severe lameness, or throat swelling become visually obvious.

77. (A) To visually detect clots, flakes, or watery milk from clinical mastitis
The Strip Cup Test is a simple, effective cow-side diagnostic routine performed before milking. Foremilk is stripped onto a fine mesh or dark surface inside a cup to visually inspect for abnormal physical alterations such as clots, flakes, blood, or watery consistency, confirming clinical mastitis and allowing immediate isolation of affected milk.

78. (C) Apply a pressure bandage above the bleed point
Severe arterial bleeding from distal limb injuries presents an immediate medical emergency. First aid protocol mandates applying a clean pressure bandage or tourniquet proximal to the bleeding site to occlude damaged arterial vessels and stem blood loss, followed by wound cleansing and prompt professional veterinary surgical intervention for definitive vessel ligation.

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one qualified Veterinary Doctor, one Paravet or veterinary assistant, and one Driver-cum-attendant. This staffing model ensures efficient mobile healthcare delivery, enabling field disease examinations, minor surgical procedures, artificial insemination, and diagnostic sample collections.

60. (B) Withdrawal period
The withdrawal period is defined as the required elapsed time between the final administration of a veterinary drug to an animal and the point when residue concentrations in edible tissues, milk, or eggs decline below established Maximum Residue Limits, ensuring animal products are completely safe for human food consumption.

61. (A) Pashudhan Bima Yojana
Pashudhan Bima Yojana, operating under the National Livestock Mission component, provides comprehensive livestock insurance coverage to protect farmers against financial losses caused by the sudden death of cattle, buffaloes, and other domestic animals due to diseases or accidents. It stabilizes farmer income and promotes sustainable livestock rearing across rural communities.

62. (C) Affixing a unique polyurethane ear tag
Under livestock health insurance schemes, fixing a unique tamper-proof polyurethane ear tag bearing a 12-digit identification number is mandatory before policy issuance. This ear tag serves as definitive proof of identity during claim processing, preventing fraudulent insurance claims and ensuring precise tracking of individual animal health and ownership records.

63. (D) Nakul Swasthya Patra
Under the Pashu Sanjeevani component of the National Mission on Bovine Productivity, tagged cattle and buffaloes receive a specialized health card termed Nakul Swasthya Patra. This card comprehensively records the animal's 12-digit UID tag number, vaccination history, deworming schedules, reproductive status, and clinical treatment interventions, aiding systematic herd health monitoring.

64. (A) P-4, Q-3, R-1, S-2
Pashudhan Bima Yojana provides financial risk coverage against animal mortality losses. NADCP executes compulsory nationwide vaccination against Foot and Mouth Disease and Brucellosis. Rashtriya Gokul Mission focuses on genetic development and conservation of indigenous bovine breeds. Pashu Sanjeevani issues Nakul Swasthya Patra health cards linked with 12-digit UID ear tags.

65. (B) Livestock Owner → Paravet / Village Level Worker → Veterinary Officer → Chief Veterinary Officer
Reporting an animal disease outbreak follows a structured bottom-up administrative chain. The livestock owner first observes and reports sick animals to the village-level Paravet or extension worker. The Paravet reports to the local Veterinary Officer, who evaluates the situation and escalates official outbreak notifications to the District Chief Veterinary Officer.

66. (C) I, II, and III only
Processing a valid livestock insurance claim upon animal death requires immediate intimation to the insurer and veterinary authority, conducting a post-mortem examination by a registered veterinarian, and submitting the official post-mortem report along with the intact ear tag. Purchasing a replacement animal beforehand is not required for claim approval verification.

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67. (C) 70%
Under government livestock insurance frameworks like Pashudhan Bima Yojana, beneficiaries belonging to Below Poverty Line (BPL), Scheduled Caste (SC), and Scheduled Tribe (ST) categories receive up to 70% premium subsidy. This financial assistance reduces the premium burden, encouraging vulnerable smallholder farmers to insure livestock against sudden animal death losses.

68. (C) Vaccinating healthy animals within a radius of the outbreak center
Ring vaccination is an epidemiological containment strategy executed during contagious disease outbreaks like Foot and Mouth Disease. It involves creating a protective immune barrier by vaccinating all susceptible, healthy animals within a designated geographic radius around the infected focal point, preventing the outward transmission and spatial spread of the virus.

69. (A) Negative energy balance causing hypoglycemia and fat breakdown
Ketosis in high-yielding dairy cows occurs during early lactation when energy demands for milk synthesis exceed dietary energy

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79. (D) Nymphomania (frequent signs of estrus)
Follicular ovarian cysts develop when a mature bovine follicle fails to ovulate or regress, persistently secreting elevated levels of estrogen. This continuous estrogenic stimulation leads to nymphomania, characterized by frequent, irregular, or continuous behavioral signs of estrus, intense mounting activity, altered vocalization, and reproductive dysfunction in affected dairy cattle.

80. (C) Practices designed to prevent disease entry and spread on a farm.
Biosecurity on a modern livestock farm encompasses a comprehensive set of management practices, hygienic protocols, and physical measures designed to mitigate risk. It prevents the introduction of external infectious pathogens onto the farm and curtails the internal dissemination of infectious diseases among resident animals, ensuring herd health and farm productivity.

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physical or clinical abnormalities of the reproductive tract.

50. (D) Anthrax
Anthrax, caused by Bacillus anthracis, is an acute, highly fatal bacterial zoonosis. Opening the carcass of a suspected anthrax case exposes vegetative bacteria to atmospheric oxygen, triggering durable endospore formation. These spores contaminate surrounding soil for decades; hence, field post-mortem examinations are strictly prohibited when anthrax infection is suspected.

51. (B) 2030
The National Animal Disease Control Programme for Foot and Mouth Disease and Brucellosis was launched in 2019 by the Government of India. The scheme targets controlling FMD disease prevalence by 2025 through comprehensive bi-annual herd vaccination and aims for full eradication of Foot and Mouth Disease across the country by 2030.

52. (C) INAPH database
Under the National Animal Disease Control Programme, each animal receives a polyurethane ear tag printed with a unique 12-digit identification number. This number links the animal's profile to the Information Network for Animal Productivity and Health (INAPH) database, enabling real-time tracking of health history, vaccination records, breeding details, and disease surveillance nationwide.

53. (B) 1962
In India, 1962 is designated as the nationwide centralized toll-free emergency helpline number for Mobile Veterinary Units under livestock health schemes. Farmers calling 1962 can request doorstep emergency veterinary diagnosis, surgical care, artificial insemination, and disease treatment services, significantly improving animal healthcare access across rural and remote agricultural areas.

54. (C) I and III only
Mobile Veterinary Units are specialized vehicles designed to deliver emergency doorstep clinical care to livestock. They provide clinical diagnosis, minor surgical operations, treatment of diseases, and artificial insemination services in remote villages. They operate purely as diagnostic and clinical service delivery units rather than schemes for distributing free milch animals to farmers.

55. (B) National Animal Disease Reporting System
The National Animal Disease Reporting System is a computerized web-based network connecting veterinary institutions across block, district, state, and national levels in India. NADRS facilitates rapid online reporting of animal disease outbreaks, enabling real-time epidemiological surveillance, early warning alerts, and effective administrative decision-making to control infectious disease spread nationwide.

56. (C) Indiscriminate use, under-dosing, and incomplete antibacterial treatments
Antimicrobial resistance in livestock develops mainly from indiscriminate use of antibiotics without professional prescription, inappropriate selection of drugs, sub-therapeutic dosing, and failing to complete full treatment courses. These practices exert selective survival pressure on bacteria, allowing resistant strains to multiply, persist in farm environments, and compromise future treatment efficacy.

57. (A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
Administering systemic antibiotics to lactating dairy cows results in drug residues passing into milk during treatment and subsequent withdrawal periods. Consuming residue-laden milk poses direct public health risks to consumers, such as severe allergic hypersensitivity reactions, and promotes selection of drug-resistant pathogens, justifying strict adherence to mandatory milk withdrawal times.

58. (A) National Animal Disease Reporting System
In veterinary epidemiology and disease management, NADRS is an official acronym for National Animal Disease Reporting System. It is an IT-enabled network operating across India that systematically captures, compiles, and analyzes block-level animal disease data, facilitating prompt official notification, epidemiological monitoring, and effective control of infectious livestock disease outbreaks.

59. (B) One Veterinary Doctor, one Paravet, and one Driver
Under standard government operational specifications in India, a Mobile Veterinary Unit is staffed by a dedicated three-member team:

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